WORK PLAN

FOR WATERSHED PROTECTION AND FLOOD PREVENTION

TRI-COUNTY TURKEY CREEK WATERSHED

JACKSON, HARMON, AND GREER COUNTIES, OKLAHOMA

February 1963

4-17638 2-63

WATERSHED WORK PLAN AGREEMENT

between the

JACKSON COUNTY SOIL AND WATER CONSERVATION DISTRICT
Local Organization
HARMON COUNTY SOIL AND WATER CONSERVATION DISTRICT
Local Organization
GREER COUNTY SOIL AND WATER CONSERVATION DISTRICT
Local Organization

TRI-COUNTY TURKEY CREEK CONSERVANCY DISTRICT
Local Organization

(hereinafter referred to as the Sponsoring Local Organization)

State of OKLAHOMA

and the

Soil Conservation Service
United States Department of Agriculture
(hereinafter referred to as the Service)

Whereas, application has heretofore been made to the Secretary of Agriculture by the Sponsoring Local Organization for assistance in preparing a plan for works of improvement for the Tri-County Turkey Creek Watershed, State of Oklahoma, under the authority of the Watershed Protection and Flood Prevention Act (Public Law 566, 83d Congress; 68 Stat. 666), as amended; and

Whereas, the responsibility for administration of the Watershed Protection and Flood Prevention Act, as amended, has been assigned by the Secretary of Agriculture to the Service; and

Whereas, there has been developed through the cooperative efforts of the Sponsoring Local Organization and the Service a mutually satisfactory plan for works of improvement for the Tri-County Turkey Creek Watershed, State of Oklahoma, hereinafter referred to as the watershed work plan, which plan is annexed to and made a part of this agreement;

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Now, therefore, in view of the foregoing considerations, the Sponsoring Local Organization and the Secretary of Agriculture, through the Service, hereby agree on the watershed work plan, and further agree that the works of improvement as set forth in said plan can be installed in about 8 years.

It is mutually agreed that in installing and operating and maintaining the works of improvement substantially in accordance with the terms, conditions, and stipulations provided for in the watershed work plan:

1. The Sponsoring Local Organization will acquire without cost to the Federal Government such land, easements, or rights-of-way as will be needed in connection with the works of improvement. (Estimated cost $ 237,599 .)

2. The Sponsoring Local Organization will acquire or provide assurance that landowners or water users have acquired such water rights pursuant to State law as may be needed in the installation and operation of works of improvement.

3. The percentages of construction costs of structural measures to be paid by the Sponsoring Local Organization and by the Service are as follows:

Works of Improvement	Sponsoring Local Organization (Percent)	Service (Percent)	Estimated Construction Cost (Dollars)
41 Floodwater Retarding Structures and 13.2 Mi. Channel Improvement	0	100	2,253,316

4. The percentages of the cost for installation services to be borne by the Sponsoring Local Organization and the Service are as follows:

Works of Improvement	Sponsoring Local Organization (Percent)	Service (Percent)	Estimated Installation Service Cost (Dollars)
41 Floodwater Retarding Structures and 13.2 Mi. Channel Improvement	0	100	646,124

5. The Sponsoring Local Organization will bear the costs of administering contracts. (Estimated cost $ 12,900 .)

6. The Sponsoring Local Organization will obtain agreements from owners of not less than 50% of the land above each reservoir and floodwater retarding structure that they will carry out conservation farm or ranch plans on their land.

7. The Sponsoring Local Organization will provide assistance to landowners and operators to assure the installation of the land treatment measures shown in the watershed work plan.

8. The Sponsoring Local Organization will encourage landowners and operators to operate and maintain the land treatment measures for the protection and improvement of the watershed.

9. The Sponsoring Local Organization will be responsible for the operation and maintenance of the structural works of improvement by actually performing the work or arranging for such work in accordance with agreements to be entered into prior to issuing invitations to bid for construction work.

10. The costs shown in this agreement represent preliminary estimates. In finally determining the costs to be borne by the parties hereto, the actual costs incurred in the installation of works of improvement will be used.

11. This agreement does not constitute a financial document to serve as a basis for the obligation of Federal funds, and financial and other assistance to be furnished by the Service in carrying out the watershed work plan is contingent on the appropriation of funds for this purpose.

    Where there is a Federal contribution to the construction cost of works of improvement, a separate agreement in connection with each construction contract will be entered into between the Service and the Sponsoring Local Organization prior to the issuance of the invitation to bid. Such agreement will set forth in detail the financial and working arrangements and other conditions that are applicable to the specific works of improvement.

12. The watershed work plan may be amended or revised, and this agreement may be modified or terminated, only by mutual agreement of the parties hereto.

13. No member of or delegate to Congress, or resident commissioner, shall be admitted to any share or part of this agreement, or to any benefit that may arise therefrom; but this provision shall not be construed to extend to this agreement if made with a corporation for its general benefit.

JACKSON COUNTY SOIL AND WATER CONSERVATION DISTRICT
Local Organization

By Ward Perryman
Ward Perryman

Title Chairman

Date March 19, 1963

The signing of this agreement was authorized by a resolution of the governing body of the Jackson County Soil and Water Conservation District
Local Organization

adopted at a meeting held on March 19, 1963

Robert McAskill
(Secretary, Local Organization)

Date March 19, 1963

HARMON COUNTY SOIL AND WATER CONSERVATION DISTRICT
Local Organization

By W. C. Williams Jr.

Title Chairman

Date March 19, 1963

The signing of this agreement was authorized by a resolution of the governing body of the Harmon County Soil and Water Conservation District
Local Organization

adopted at a meeting held on March 19, 1963

Claud Ingram
(Secretary, Local Organization)

Date March 19-1963

GREER COUNTY SOIL AND WATER CONSERVATION DISTRICT
Local Organization

By E. F. Dropeck

Title Chairman

Date March 19-1963

The signing of this agreement was authorized by a resolution of the governing body of the Greer County Soil and Water Conservation District
Local Organization

adopted at a meeting held on march 19, 1963

(acting) Leonard Grauman
(Secretary, Local Organization)

Date march 19, 1963

TRI-COUNTY TURKEY CREEK CONSERVANCY DISTRICT
Local Organization

By Ward Perryman
Ward Perryman

Title Chairman

Date 3-19-63

The signing of this agreement was authorized by a resolution of the governing body of the Tri-County Turkey Creek Conservancy District
Local Organization

adopted at a meeting held on March 19, 1963

Neff Bullington
(Secretary, Local Organization)

Date March 19, 1963

Local Organization

By____________________________

Title____________________________

Date____________________________

The signing of this agreement was authorized by a resolution of the governing body of the ____________________________

Local Organization

adopted at a meeting held on ____________________________.

(Secretary, Local Organization)

Date____________________________

Soil Conservation Service
United States Department of Agriculture

By____________________________

Date____________________________

WORK PLAN

FOR

WATERSHED PROTECTION AND FLOOD PREVENTION

TRI-COUNTY TURKEY CREEK WATERSHED
Jackson, Harmon, and Greer Counties, Oklahoma

Prepared Under the Authority of the
Watershed Protection and Flood Prevention Act
(Public Law 566, 83rd Congress; 68 Stat. 666),
as Amended

Prepared By:

Jackson County Soil and Water Conservation District
(Cosponsor)

Harmon County Soil and Water Conservation District
(Cosponsor)

Greer County Soil and Water Conservation District
(Cosponsor)

Tri-County Turkey Creek Conservancy District
(Cosponsor)

With Assistance By:

U. S. Department of Agriculture
Soil Conservation Service

February 1963

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WATERSHED WORK PLAN

TRI-COUNTY TURKEY CREEK WATERSHED
Jackson, Harmon, and Greer Counties, Oklahoma
February 1963

SUMMARY OF PLAN

General Summary

The work plan for watershed protection of the Tri-County Turkey Creek watershed, Oklahoma, was prepared by the Jackson, Harmon, and Greer County Soil and Water Conservation Districts and the Tri-County Turkey Creek Conservancy District as the cosponsoring local organizations, with technical assistance by the U. S. Department of Agriculture. The Tri-County Turkey Creek Watershed Association has furnished overall leadership in promoting the educational and informational phase of the work plan development and will continue to assist in carrying out the project.

Turkey Creek rises eight miles northwest of Gould, Oklahoma, and flows in a southeasterly direction into the Salt Fork of Red River near Olustee, Oklahoma. This watershed covers an area of 306.88 square miles, or 196,400 acres. Land use in the watershed is approximately 61 percent cropland, 30 percent rangeland, 8 percent formerly cultivated, and 1 percent miscellaneous uses such as stream channels, towns, and roads. There are no Federal lands in the watershed.

The flood plain of this creek and its tributaries is subject to frequent small floods, with the larger more severe floods occurring every 3 to 5 years. The most recent large flood was in October 1960.

The installation and operation of the project will reduce the average annual floodwater, sediment, and erosion damage 85 percent. This reduction meets the agreed-upon project objectives. The reduction in frequency, time of inundation, and depth of flooding will allow the landowners and operators to more fully develop the irrigation potential of the flood plain. Agricultural benefits accruing to the project are based on the reduction of damages on 12,328 acres of flood plain.

The work plan proposes installing in an 8-year period a project for the protection and development of the watershed at a total cost of $4,943,847. The share of this cost to be borne by Public Law 566 funds is $2,997,840. The share to be borne by other than Public Law 566 funds is $1,946,007.

Land Treatment Measures

The governing bodies of the Jackson County, Harmon County, and Greer County Soil and Water Conservation Districts will assume aggressive leadership in accelerating the planned land treatment measures. Land treatment measures

will be installed which have a measurable effect on the reduction of floodwater, sediment, and erosion damages. These measures are itemized in table 1.

The cost of land treatment measures is estimated to be $1,793,908, of which the other than Public Law 566 share is $1,695,508, including expected reimbursements from ACPS. The Public Law 566 share, which consists entirely of accelerated technical assistance, is $98,400.

Structural Measures

The structural measures included in the plan consist of 41 floodwater retarding structures and 13.2 miles of channel improvement. The structures will have a total floodwater detention and sediment storage of 29,311 acre-feet. The total cost of these measures is $3,149,939, of which the cost to other than Public Law 566 funds is $250,499 and the Public Law 566 share is $2,899,440. The local share of the cost of structural measures includes land, easements, rights-of-way, removal or relocation of roads, pipelines, utilities, and improvements ($237,599), and administration of contracts ($12,900).

Project Benefits

The average annual flood damage in the watershed under non-project conditions is estimated to be $249,876. The average annual damage after project installation, including both land treatment and structural measures, is estimated to be $38,552. The difference of $211,324 represents an overall average annual reduction in flood damage of 84.6 percent. Of this total, $8,453 is attributed to the reduction of damages by the installation of land treatment measures. The conservation benefits of land treatment measures were not used for project justification since experience has shown that these soil and water conservation measures produce benefits in excess of their costs.

Processors of agricultural commodities and other businesses in the area will benefit from the project.

The average annual primary project benefits are estimated to be $276,514, distributed as follows:

Floodwater damage reduction	$161,988
Sediment damage reduction (overbank deposition)	20,181
Erosion damage reduction (flood plain scour)	9,944
Indirect damage reduction	19,211
More intensive land use	65,190

Secondary benefits will average $26,444 annually.

The ratio of average annual benefits accruing to structural measures ($294,505) to the average annual cost of structural measures ($128,375) is 2.3 to 1.

Provisions for Financing Construction

The Jackson County, Harmon County, and Greer County Soil and Water Conservation Districts are legal subdivisions of the State of Oklahoma. Each has powers of eminent domain and the authority to use State revolving funds in watershed operations. Each soil and water conservation district, with the assistance of the Tri-County Turkey Creek Conservancy District, will obtain easements within its own district and will provide for local installation costs by donation of land and other services, and by use of State, county, or local revolving funds.

Should funds obtained by the above methods be exhausted, consideration will be given to additional funds needed and the methods of obtaining them. The sponsors then may decide to apply for a loan through the Farmers Home Administration.

The Tri-County Turkey Creek Conservancy District is a legal subdivision of the State with powers of assessment and eminent domain. Through its powers of assessment, the conservancy district will raise additional funds. If a loan is obtained from the Farmers Home Administration, the conservancy district will use its powers to assure repayment of the loan.

Operation and Maintenance

Land treatment measures will be maintained by the landowners or operators of the farms on which the measures are installed, under agreements with the soil and water conservation districts. The 41 floodwater retarding structures and the 13.2 miles of channel improvement will be operated and maintained by the soil and water conservation districts jointly with the Tri-County Turkey Creek Conservancy District. The latter has legal authority to raise and expend funds for this purpose. The estimated average annual cost of operation and maintenance of the floodwater retarding structures is $8,835.

DESCRIPTION OF THE WATERSHED

Physical Data

Tri-County Turkey Creek watershed, with a drainage area of 196,400 acres (306.88 square miles) is located in southwestern Oklahoma between the cities of Altus and Hollis.

The watershed contains 84,040 acres in Jackson County, 63,360 in Harmon County, and 49,000 in Greer County. Turkey Creek rises 8 miles northwest of Gould, Oklahoma, and flows in a southeasterly direction for approximately 35 miles to its confluence with Salt Fork of Red River near the town of Olustee. The major tributaries are Cottonwood Creek, Russell Hollow, Spring Creek, and Horse Branch.

The main stem flood plain averages about 4,000 feet in width between Duke and Olustee and about 2,000 feet upstream from Duke.

The flood plain of Russell Hollow ranges as much as one mile wide, narrowing to 1,500 feet at its confluence with Turkey Creek. The flood plain width of Cottonwood Creek averages about 1,500 feet. Flood plains of the other tributaries average 500 feet or less.

The watershed lies in the Red Hills Physiographic Area and the Rolling Red Plains Land Resource Area. The topography is a nearly level to gently undulating plain of low relief, irregularly broken by dissected areas characterized by short, steep, and irregular slopes. In the vicinity of Duke, a small area of karst topography, characterized by sinkholes, has developed over gypsum beds. The mean sea level elevation ranges from around 1,320 feet in the flood plain at Olustee to 1,876 feet in the upper reaches of the watershed.

The geologic formations occurring in the watershed are of the Permian and Quaternary periods. The Permian age beds are represented by the Flowerpot shale, Blaine gypsum, Dog Creek shale, and Whitehorse group. The Flowerpot shale consists of red and brown silty and clayey shale, thin impure gypsum beds, and light gray dolomite. The overlying Blaine formation includes strata characterized by thick beds of gypsum. The Dog Creek shale is principally red, brown, and green gypsiferous shale containing a few thin beds of dolomite, gypsum, and siltstone. The Whitehorse formation is of minor extent and consists of a soft, red silty sandstone.

Quaternary deposits of sand and silt cover the Permian beds in the uppermost part of the watershed. The upland soils of the watershed range from clay loams to stony loams and from fine sandy loams to loamy fine sands. The soils developed from shales are of the largest areal extent. They are fine textured and range from very slowly to slowly permeable. Stony, shallow soils are underlain by thin beds of dolomitic limestone. Soils from sandstones and the predominantly sandy beds of Quaternary age are medium to coarse textured

and from moderately to freely permeable. The bottomland soils, developed from Recent alluvium, are fine to medium textured and slowly permeable to permeable. All the soils have been developed under a native vegetation ranging from short to tall grasses.

There are 11 range sites in the watershed. These sites are Hardlands, Shallow Prairie, Red Clay Prairie, Red Clay Flats, Breaks, Deep Sand, Subirrigated, Loamy Prairie, Sandy Plains, Loamy Bottomland, and Sandy Bottomland. The cover on native range varies from poor in the rough broken areas to fair on the smoother slopes.

The overall land use is:

Land Use	Acres	Percent
Cropland	120,000	61.1
Rangeland	59,300	30.2
Formerly Cultivated	15,900	8.1
Miscellaneous uses, roads, towns, etc.	1,200	0.6
Total	196,400	100.0

The watershed lies in the dry subhumid climatic zone. The average frost-free period of 225 days extends from March 26 to November 6. Average temperatures range from 84 degrees Fahrenheit in summer to 40 degrees in winter. The mean annual temperature is 62 degrees Fahrenheit. The extreme temperatures recorded at Mangum are 17 degrees below zero and 117 degrees above zero.

The Mangum Weather Station, located 4 miles north of the watershed, has a 70-year record. Based on the 70-year period the average annual rainfall is 23 inches, ranging from a minimum of 14.02 inches in 1936 to a maximum of 45.13 inches in 1923.

On the average, 42 percent of the annual rainfall occurs in the months of April, May, and June and 35 percent in July, August, September, and October. The remaining 23 percent is distributed evenly throughout the other 5 months. Most of the flood damages occur during the spring months and are caused by storms of high intensity rainfall. Summer rains are spotty and irregular and dry spells of 4 to 6 weeks are fairly common. Winter rains are fairly gentle and steady and the amount of precipitation is usually low.

Well water for irrigation is obtained from the Blaine formation at depths ranging from 50 to 150 feet. Farm ponds and wells supply most of the water for livestock. Much of the well water is not fit for human consumption because of its high mineral content. Where well water is not suitable for household use, many farmers collect water in cisterns or haul water from nearby towns.

Economic Data

The land within the watershed is owned and operated mostly by farmers and

ranchers. The principal crops consist of wheat, other small grain, cotton, alfalfa, and grain sorghum. The size of the farms ranges from 80 acres to more than 2,000 acres. The average size farm unit as reported by the 1959 Census of Agriculture is 451 acres. The value of land and buildings was reported to average $40,000 or an equivalent value of $90 per acre.

The watershed is located in an area of intensive cultivation. Large acreages of wheat and cotton occur throughout the watershed. Almost all of the cotton acreage is irrigated from wells or from Turkey Creek. Wheat is also irrigated during years of below average rainfall. It is not uncommon for one farmer to farm 400 to 1,200 acres of wheat on a rental basis for the owners of 3 to 4 farms. It is also a common practice for a cotton farmer to farm the allotted acres on 3 or more farms. The irrigation systems occur on the uplands as well as on the bottomlands.

The value of the flood plain land ranges from $200 to $500 per acre, depending on the availability of suitable water for irrigation. The value of upland ranges from $25 to $300, depending on the supply of water.

The rangeland occurs mostly on rough, broken, and shallow soil areas throughout the watershed. The rangeland has a low grazing capacity and is comprised primarily of native short grasses adapted to areas of low rainfall and shallow soils. The principal livestock enterprise consists of the grazing of steers on wheat pasture during the fall and winter months when soil moisture conditions permit an early growth of wheat and other small grains. As many as 80,000 head of steers have been grazed in the watershed from late October to March during favorable years.

The production of high quality alfalfa seed was once an important economic enterprise of this area. The alfalfa, grown on upland and bottomland, usually was mowed for hay one or two times per season and then allowed to produce a seed crop. The invasion of the fields by the aphid in the late 1950's has practically eliminated this crop. Farmers interviewed during the development of the work plan indicated that this crop would again be significant when an acceptable resistant variety is developed.

The towns of Olustee, Duke, and Gould, 1960 population of 463, 333, and 241, respectively, are in the watershed. Although many farmers live on their farms, others live in these small towns and nearby cities. Since most owners and operators farm more than one unit, the trend seems to be to locate in the small towns as a center for their operations.

Altus, 1960 population of 21,225, is situated on U. S. Highway 62 just six miles east of the watershed boundary. This city is an important trading center, market place for agricultural products, and the principal source of equipment, fuel, insecticides, fertilizers, and other items needed for the production of crops for the watershed and surrounding territory.

U. S. Highway 62 traverses the lower portion of the watershed and State Highway 34 traverses the eastern portion. Other all-weather, farm-to-market

roads occur throughout the area, and most of the watershed is accessible by county roads. Large storms cause inundation of bridges, preventing access to many areas for long periods of time.

The Hollis and Eastern Railroad operates from Altus to Hollis, crossing the lower portion of the watershed. Many elevators and freight loading docks are along the route, including those at Duke and Gould.

Land Treatment Data

The watershed is served by Soil Conservation Service work units located at Altus, Hollis, and Mangum. The work units are providing technical assistance to the soil and water conservation districts in Jackson, Harmon, and Greer counties. The work units have assisted the farmers and ranchers in the preparation of 609 basic soil and water conservation plans on 143,900 acres. About 65 percent of the planned practices have been applied.

WATERSHED PROBLEMS

Floodwater Damage

The flood plain is considered as the area that would be inundated by the runoff from a 24-hour, 25-year frequency storm. The total flood plain area is 14,778 acres, including 2,200 acres of stream channel. The flood plain, excluding stream channels, is divided into evaluation reaches as follows: Reach A, 1,944 acres; Reach B, 1,407 acres; Reach C, 5,011 acres; Reach D, 2,766 acres; and Reach E, 1,450 acres (figure 4).

The flood plains of Reach A and Reach D are highly developed and intensively farmed. These reaches are characterized by wide, fairly level bottomland fields, with a portion of each farm being flood irrigated at the present. Many irrigation wells and associated equipment lie within the flood plain area. Cotton and wheat, irrigated in large fields, are the principal crops. The land in these two reaches is valued from $300 to $500 per acre.

Small floods occur in these two reaches more than once a year, on the average. Large floods occur at intervals of once in four years, on the average. Floods generally occur in the spring months, but both large and small floods have occurred in the fall months. Floodwater damage occurs to growing crops, irrigation systems (including damage to equipment, borders, ditches, land gradient, etc.), fences, levees, roads, bridges, deposition of debris and loss of time due to detours that create travel problems during planting, cultivating, and harvesting seasons. The frequency of flooding has prevented farmers from fully developing the resources of the flood plain for irrigated crops.

The flood plain of Reach B along the main stem of Turkey Creek is characterized by a winding channel through rough, shallow soils. A very small amount of flood plain in this section is cultivated. The principal damage done by floodwater in this reach is to native range, fences, roads, and bridges.

Flooding of wheat fields and county road 3 miles north of Olustee, Oklahoma after storm of May 1955.

Floodwater damage near cross-section 19 from storm of May 1955.

Jackson County Soil and Water Conservation District Board Members
Ward Perryman and Bob McAskill view the damage
during the flood of October 18, 1960.

Flooding south of Duke, Oklahoma, October 18, 1960.

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There are two intensively farmed laterals in this reach that drain into Turkey Creek from the north. Their flood plains are irrigated, wells are located in the flood zone, and much the same type of damage occurs on these two laterals as in Reaches A and D. Farmers have been unable to develop the flood plains of these laterals to their fullest potential due to the periodic damaging floods.

The flood plain lands of Reach C lie at a higher elevation above the main channel of Turkey Creek than those of Reaches A, B, or D. The opportunities for irrigation in this reach are not as good as those in the above reaches. Farmers depend on the flow of water in the creek for the principal source of irrigation water, although a few irrigation wells exist. Flood frequency in this reach is less than in the other reaches. The damage caused from floodwater, however, has prompted farmers to plant row crops on higher ground. This is particularly true of cotton. Farmers reported that soil loss from the scouring action of floodwater was too severe to risk continual losses of this nature. Wheat and other small grains have replaced cotton in the flood plain. Some irrigation systems were abandoned.

Floodwaters in Reach C damage irrigation pumps and motors installed along the banks of Turkey Creek, growing crops and pasture, fences and water gates, level-bordered irrigation land, major county bridges, and State, Federal, and county highways, roads, and bridges. Other damage results from the loss of livestock by drowning and the deposition of debris on cropland. Interruption of travel, halting of mail and school bus service, and delay in transportation of cultivating and harvesting equipment constitute serious problems.

The most damaging flood within the memory of the residents in the watershed occurred during the week of May 12-19, 1935. Five inches of rain fell during the first five days of the storm followed by six inches on the sixth day. During this storm, three residences in Reach C washed away during the night, marooning 15 people, seven of whom drowned.

The upper 20 percent of Reach E consists of steep escarpments and rough broken land. The remainder of the reach is made up of nearly level to gently sloping land with little or no well defined drainageways. Lack of defined drainageways permits runoff to spread over wide areas. The main channel of the reach is shallow and is bordered by a narrow flat area confined by an irregular low terrace approximately four feet in height. When the floodwaters exceed the depth of the terrace, they flow across the wide fields that are usually in wheat and other small grains.

The flood frequency of Reach E consists of two or more small floods per year, on the average, with large floods having an average occurrence of once every two or three years. Only one irrigation well exists in the reach. The topography is not favorable for irrigation or livestock water storage structures. The damages caused by floodwater in this area are usually to growing crops and pastures, fences, roads, and bridges, plus the interruption of travel and the halting of mail and school bus service.

The most recent flood that occurred in the watershed was on October 18, 1960. An intense rainfall of 3.8 inches fell after the watershed had received soaking rains for several days. An estimated 11,600 acres were flooded, destroying many acres of a mature cotton crop, doing extensive damage to irrigation systems, damaging levees, causing extensive scouring to recently planted wheat fields, washing out county bridges and approaches, and destroying several miles of fences. The monetary damage caused by this storm is estimated to be $264,300. Recent floods have also occurred in the month of May in 1953, 1955, 1957, and 1959. An October flood in 1955 also did extensive damage.

Sediment Damage

Damage by sediment deposition has not been widespread over the flood plains of the watershed. A total of 1,889 acres, 15.3 percent of the total flood plain has been damaged by deposits of silty clay, clayey sand and loamy sand. These deposits range in depth from 6 inches to 3 feet. Damages range from slight to moderately severe in terms of reduced productive capacity.

Most of the overbank deposition has occurred in Reach A (Upper Turkey Creek), Reach D (Russell Hollow), and on Cottonwood Creek. Sediment damage in Reach A, which includes the upper flood plain of Turkey Creek, totals 933 acres or 49.4 percent of the area damaged. At present on Reach A there are 152 acres damaged 10 percent; 410 acres, 20 percent; 316 acres, 40 percent; and 55 acres, 60 percent. Channel filling has been severe in this area, and the loss of carrying capacity has increased the frequency of overflow and amount of sediment deposition.

Deposition of sediment has damaged 619 acres or approximately 23 percent of the flood plain of Reach D. The estimated damages are: 192 acres, 10 percent; 286 acres, 20 percent; and 141 acres, 40 percent. Sediment has completely filled portions of the original channel in the lower portion of this reach resulting in more frequent flooding. However, swamping has not resulted from channel filling.

Irrigation systems have been damaged by sediment deposition, necessitating releveling of land, rebuilding of borders, cleaning out irrigation ditches, and the replacing of irrigation pipe.

Reach C includes Cottonwood Creek and the lower flood plain of Turkey Creek. Deposition of sediment has damaged 337 acres or nearly 8 percent of the flood plain in this reach. The estimated acres damaged in terms of reduced productivity are 235 acres, 10 percent, and 102 acres, 20 percent. Channel filling is not significant in the reach.

Sediment damage to farm ponds ranges from moderate to severe. Most of the ponds are located in areas where the soils are shallow and the vegetation is sparse.

Erosion Damage

Erosion in the form of sheet and channel scour has damaged 1,614 acres or 13 percent of the flood plain. It is estimated that the productive capacity of the acres damaged has been reduced by 10 percent on 872 acres, 20 percent on 604 acres, 40 percent on 112 acres, and 60 percent on 26 acres. Most of the damage has been in the form of sheet scour, which has removed 4 to 12 inches of the surface soil. Streambank erosion is not significant.

Sheet erosion on cultivated land and rangeland with very poor cover is the major source of sediment from the uplands. Approximately 99 percent of the sediment produced from the upland area results from sheet erosion. Road and gully erosion contribute one percent.

Of the total annual gross erosion in the watershed, it is estimated that 87 percent results from upland sheet erosion, 12 percent from flood plain scour, and 1 percent from road and gully erosion.

Erosion caused by burning of grass or crop residue has not been a problem in the watershed.

Problems Relating to Water Management

The towns of Duke and Olustee obtain their water from wells, and, although the supply appears to be adequate, the quality is poor. A supply of better quality water from surface storage is desired by these towns.

Local farmers have been irrigating from wells drilled in the Blaine formation since 1949. Even though the water level has fluctuated, no serious shortage has developed to date. The quality of water is variable but has proven to be suitable for irrigation use. After 13 years of use, no serious salinity problem has developed. Flood damage to irrigation systems on the flood plain has caused several farmers to move their irrigation facilities to less productive uplands. Irrigation is needed since rainfall varies so widely from year to year. Some years complete crop failures occur due to lack of sufficient precipitation.

There is a need for more opportunities for fishing, hunting, and the development of recreation facilities for the people of the watershed and adjacent towns since the only major reservoir in this area is Lake Altus. This multiple-purpose project of the Bureau of Reclamation is located about 50 miles northeast of Gould.

PROJECTS OF OTHER AGENCIES

Lake Texoma, a flood control and power reservoir on Red River, located at the junction of the Washita and Red Rivers and about 180 miles southeast of this watershed, was completed by the Corps of Engineers in 1942. The proposed project will reduce the volume of sediment now being delivered to the Red River and Lake Texoma from this watershed, but such benefits were not used to justify the works of improvement included in this plan.

BASIS FOR PROJECT FORMULATION

Project formulation was based on the need for adequate flood protection to the flood plain land of Turkey Creek. Due to the extent of existing and potential irrigation development, the sponsors and the Service agreed that a plan should be developed for a project of structures and channel improvement that would reduce existing damages by 75 to 85 percent.

In selecting sites for floodwater retarding structures, consideration was given to locations which would provide the desired level of protection to areas subject to flood damage. The size, number, and cost of the structures were influenced by the complex topographic and geologic conditions of the watershed and the scarcity of suitable embankment material.

Several key sites did not have sufficient storage capacity because of physical limitations. It was necessary to add sites upstream in series with these locations in order to meet the minimum storage requirements.

The possibility of adding water storage for agricultural and nonagricultural water management was considered. The nature of geologic formations underlying structure sites was such that the water holding ability for multiple-purpose use was doubtful. After detailed site investigations are made in the design stage, the feasibility of including additional storage for irrigation or recreation on individual sites will be reconsidered.

The installation of special measures for ground water recharge was studied by the local sponsors. Due to the difficulty of determining the extent or amount of recharge such measures would provide, the sponsors requested that this purpose be considered only as incidental to the other project purposes.

WORKS OF IMPROVEMENT TO BE INSTALLED

Land Treatment Measures

An effective conservation program based on the use of each acre of agricultural land within its capabilities and its treatment in accordance with its needs, such as is now being carried out by the Jackson County, Harmon County, and Greer County Soil and Water Conservation Districts, is necessary for a sound watershed protection and flood prevention program. Basic to reaching this objective is the establishment and maintenance of all applicable soil and water conservation and plant management practices essential to proper land use. Emphasis will be placed on accelerating the establishment of land treatment practices which have a measurable effect on the reduction of floodwater, sediment, and erosion damages.

Land treatment for the area above floodwater retarding structures is

important for protection of the watershed. Land treatment measures will help the structural measures to function more efficiently by reducing runoff and sediment delivered to them. Land treatment constitutes the only planned measures for the remaining upland drainage area of the watershed.

The amounts and estimated cost of the measures that will be installed by landowners and operators during the 8-year installation period are shown in table 1.

Land treatment measures will decrease erosion damage and sediment production from fields and pastures by providing improved soil-cover conditions. These measures include conservation cropping systems, cover and green manure crops, crop residue use, stubble mulching, range seeding, and pasture planting to establish good cover on grassland and formerly cultivated lands. They also include construction of farm ponds to provide adequate watering places for livestock and uniform distribution of grazing, and proper use of rangeland to provide improvement, protection, and maintenance of grass stands. These measures also effectively improve soil conditions which allow rainfall to soak into the soil at a more rapid rate.

Loss of upland game habitat as a result of construction of floodwater retarding structures will be offset by the establishment of 650 acres of wildlife habitat improvement planned under the accelerated land treatment program. These habitat developments will be closely correlated with the reservoir system. The combined program of land treatment and floodwater retarding structures will improve waterfowl conditions in the watershed and will afford better fishing opportunities. The channel improvement included in this plan will not result in loss of habitat since it is in areas of intense cultivation.

In addition to the soil improving and cover measures, land treatment includes contour farming, terracing, diversion construction, and grassed waterways to serve these measures, which in combination have a measurable effect in reducing peak discharge by slowing runoff water from fields and in reducing erosion damage and sediment production.

The practice of land leveling and land smoothing for conservation and better distribution of irrigation water will be installed on those lands where irrigation water is available.

Structural Measures

A system of 41 floodwater retarding structures, typical of that shown in figure 1, and 13.2 miles of channel improvement having an installation cost of $3,149,939 will be installed to afford the needed protection to flood plain lands which cannot be provided by land treatment measures alone.

The system of floodwater retarding structures will detain the runoff of a 25-year frequency storm from approximately 59 percent of the entire watershed and 79 percent of the area above cross section 27 (4 miles northwest of Duke, Oklahoma). These structures will have a total floodwater detention capacity of 21,222 acre-feet and will detain an average of 3 inches of runoff from the watershed area above them. The sediment storage provided for each structure is based on the estimated accumulation for a 50-year period.

The sediment pools will inundate 356 acres of bottom land and 220 acres of upland. The detention pools will temporarily inundate an additional 1,197 acres of bottom land and 2,220 acres of upland. There are 250 acres of flood plain land included in the 356 acres of bottom land inundated by the sediment pools.

There will be 13.2 miles of channel improvement installed in Reaches A and D to provide the level of protection agreed to by the sponsors and the Service that cannot be provided by retardation alone. The channel will be designed to contain the runoff from a 24-hour storm that can be expected to occur on an average of once in five years.

Sufficient detention storage and combination release flow can be developed in all floodwater retarding structures to make possible the use of vegetative emergency spillways. Sediment pool design will conform with Oklahoma Water Resources Board Resolution dated January 10, 1961, and all applicable State water laws.

Locations of structural measures are shown on the project map, figure 5. Structure data and costs for individual structural measures are included in tables 1, 2, 3, and 3A.

EXPLANATION OF INSTALLATION COSTS

Public Law 566 funds are expected to provide technical assistance in the amount of $98,400 during the 8-year installation period to accelerate the installation of land treatment measures included in the plan for watershed protection. These funds will be in addition to $56,000 of Public Law 46 funds provided under the going program. Local interests will install these measures at an estimated cost of $1,639,508, which includes ACPS payments based on present program criteria (table 1).

Land, easements and rights-of-way for all structural measures will be furnished by the local organizations. The required local costs for structural measures are estimated at $250,499. These consist of the value of land easements ($199,289); changes in utilities ($3,500); roads ($28,890); legal fees ($5,920); and administration of contracts ($12,900).

The construction cost of structural measures amounting to $2,253,316 and the associated installation services cost of $646,124 will be borne by

Public Law 566 funds. This is a total Public Law 566 cost of $2,899,440 for the installation of structural measures.

Construction costs include the engineer's estimate and contingencies. The engineer's estimates were based on the unit costs of floodwater retarding structures in similar areas modified by special conditions inherent to each individual site. Special features considered necessary were flattening of natural slopes, excavating larger than normal core trenches, flattening embankment slopes, fill required in emergency spillway, zoned embankment, and overhaul of fill material from selected borrow sites. Ten percent of the engineer's estimate was added as a contingency to provide funds for unpredictable construction costs. These costs were based on data obtained from semi-detailed geologic investigations of five problem sites, with surface observation and shallow borings on the remaining sites.

Installation services include engineering and administration costs. These estimates were based on an analysis of previous work in similar areas.

The estimated schedule of obligation for the 8-year installation period covering installation of both land treatment and structural measures is:

Schedule of Obligations

Fiscal Year	Measures	Public Law 566 Funds (dollars)	Other Funds (dollars)	Total (dollars)
1st	Sites 1, 1A, 2, 2A, 3 through 7, and 9	570,936	76,124	647,060
	Land Treatment	13,992	211,942	225,934
2nd	Channel Improvement - Reach A Sites 8, 10 through 13, 14A, 14B, 14C, 15	586,747	56,365	643,112
	Land Treatment	13,992	211,938	225,930
3rd	Sites 14, 16A, 16 through 19, 29A, 29B	629,833	29,270	659,103
	Land Treatment	13,992	211,938	225,930
4th	Channel Improvement - Reach D Sites 20 through 24, 29	537,961	42,330	580,291
	Land Treatment	13,992	211,938	225,930
5th	Sites 25 through 28, 28A, 28B, 28C, 28D	573,963	46,410	620,373
	Land Treatment	13,992	211,938	225,930
6th	Land Treatment	9,480	211,938	221,418
7th	Land Treatment	9,480	211,938	221,418
8th	Land Treatment	9,480	211,938	221,418
	Total	2,997,840	1,946,007	4,943,847

This schedule may be adjusted from year to year on the basis of any significant changes in the plan found to be mutually desired, and in the light of appropriations and accomplishments actually made.

EFFECTS OF WORKS OF IMPROVEMENT

Under present conditions, a 24-hour, 25-year frequency storm will yield 3.12 inches of surface runoff which will inundate 12,328 acres of flood plain land below floodwater retarding structures. Agricultural benefits accruing to the project are based on the reduction of damages on these 12,328 acres. The installation of the accelerated land treatment measures will cause a reduction of this runoff to 3.02 inches and will reduce the flooded area to 12,140 acres. The installation of the structural measures will further reduce flooding to 5,132 acres (figure 3).

Average annual flooding in the evaluated area will be reduced from 6,275 acres to 1,550 acres. The following table illustrates the acres flooded by storms of specified frequency without and with the completed project.

Frequency 1/ (Years)	Runoff (Inches)	Item	Acres Flooded Below Site Locations By Reaches					Total
			A	B	C	D	E	
25	3.12	2/	1,854	1,387	4,971	2,676	1,440	12,328
		3/	660	945	878	1,710	939	5,132
		4/	64	32	82	36	35	58
10	2.31	2/	1,713	1,257	3,555	2,474	1,160	10,159
		3/	450	651	260	1,250	812	3,423
		4/	74	48	93	49	30	66
2	1.12	2/	1,480	1,041	503	2,134	695	5,853
		3/	130	215	85	255	474	1,159
		4/	91	79	83	88	32	80

1/ 24-hour duration storms.
2/ Without project.
3/ With project.
4/ Percent reduction.

Application of planned land treatment measures will reduce upland erosion from an annual gross volume of approximately 530 acre-feet to 486 acre-feet, a decrease of 9 percent.

Flood plain scour accounts for about 12 percent of the present annual gross erosion in the watershed. The project will prevent further damage to approximately 1,074 acres of the 1,614 acres now damaged by scour. About 1,217 of the 1,889 acres presently damaged by overbank deposition will be protected from further damage.

The construction of the floodwater retarding structures and the channel improvement will permit farmers to further develop the flood plain lands for irrigation. The reduction in the frequency, time of inundation, and depth of flooding will allow the owners and operators to fully utilize ground water sources for maximum irrigation use. A more efficient job of land leveling, water distribution, and water application will permit farmers to farm the land more intensively. The better use of water, the application of fertilizers, and the reduced risk of land damage will permit farmers to obtain higher crop yields, particularly cotton, alfalfa, and grain sorghums.

An estimated 160 farmers and landowners will be benefited by the completion of the project.

The wide range of farming activities of many farmers requires a considerable amount of travel. The structural measures will reduce the recurring loss of bridges on county roads and the frequency that roads are closed because of high water.

It is believed that benefits will accrue to the project as a result of ground water recharge. The recharge is expected to take place in the Quaternary deposits and the Blaine formation through cavernous gypsum beds. Since it is impossible to determine the amounts and the location of the recharge, no monetary benefits were determined.

PROJECT BENEFITS

The estimated average annual monetary floodwater, sediment, erosion, and indirect damages (table 5) within the watershed will be reduced from $249,876 to $38,552 by the proposed project. This is a reduction of 85 percent, 96 percent of which will result from the system of structural measures.

Reduction in area inundated and monetary flood damages vary with respect to location within the watershed. For instance, along evaluation Reaches A and D, damageable values are found at a low elevation. Consequently, channel improvement designed to carry the runoff from a 5-year frequency storm has been included as a part of the total project. The general location of damage reduction benefits attributed to the combined project of land treatment and structural measures are presented in the following tabulations.

Average Annual Damage

Evaluation Reach	Location	Without Project 1/	With Project 1/	Reduction
(figure 4)		(dollars)	(dollars)	(percent)
A	Upper Turkey Creek above Cross Section 29	75,643	8,854	82
B	Main stem of Turkey Creek between Cross Sections 26 and 29 plus two laterals	21,642	6,862	68

Average Annual Damage - Continued

Evaluation Reach (figure 4)	Location	Without Project 1/ (dollars)	With Project 1/ (dollars)	Reduction (percent)
C	Lower main stem of Turkey Creek below Cross Section 26, including Cottonwood Creek	48,776	7,171	85
D	Tributary to main Turkey Creek northwest of Duke, known as Russell Hollow	92,489	9,666	90
E	Horse Branch tributary above Floodwater Retarding Structure 28	11,326	5,999	47
	Total	249,876	38,552	85

1/ Long-term prices.

It is estimated that the net increase in income from a more intensive use of the flood plain lands will amount to $65,190 annually (at long-term levels). This is a result of the flood protection which enables farmers to make greater use of ground water supplies and better distribute, conserve, and apply irrigation water to crops. This increase in net income is the result of increased yields and the use of higher value crops.

Annual secondary benefits in the amount of $26,444 will accrue to the project as a result of the system of floodwater retarding structures and channel improvement. These benefits include those resulting from the increased net return to suppliers of farm equipment and materials needed to achieve the increased agricultural production made possible by the project. They also include the increased net return to local retailers and wholesalers from consumer expenditures by the farm family resulting from increased farm income. These benefits were used for project justification.

Secondary benefits from a national viewpoint were not considered pertinent to the economic evaluation and were not evaluated. Neither recreation nor redevelopment benefits were evaluated or used in the justification of the project.

The total flood prevention benefits resulting from structural measures are estimated to be $294,505 annually. In addition to the direct monetary benefits, there are other substantial benefits which will accrue to the project such as an increased sense of security and better living conditions. These benefits were not evaluated in monetary terms nor have they been used for project justification.

Within the watershed, the average annual flood reduction benefits from land treatment measures will amount to $8,453. These benefits have not been used for project justification.

COMPARISON OF BENEFITS AND COSTS

The average annual cost of structural measures (amortized from total installation cost, plus operation and maintenance) is $128,375. The installation of the structural measures is expected to produce average annual primary benefits of $268,061. The ratio of primary benefits to cost will be 2.09 to 1.

Total benefits, including secondary benefits, from the structural measures will provide a benefit of $2.29 for each dollar of equivalent cost (table 6).

PROJECT INSTALLATION

The Tri-County Turkey Creek Watershed Association was organized to unite the leadership of the watershed into one group having a common goal. The group is composed of representatives from all of the local sponsoring organizations and other groups interested in establishing flood control measures. The association will assist in establishing policies, initiate action, help achieve understanding and stimulate participation in the entire plan.

Land Treatment Measures

The land treatment measures, itemized in table 1, will be established on non-Federal land by farmers and ranchers over an 8-year period in cooperation with the Jackson County, Harmon County, and Greer County Soil and Water Conservation Districts, which are giving technical assistance in the planning and application of these measures under its going program. This assistance will be accelerated with Public Law 566 funds to assure application of the planned measures within the 8-year project installation period.

The governing bodies of the Jackson County, Harmon County, and Greer County Soil and Water Conservation Districts will assume aggressive leadership in accelerating the planned land treatment measures. The landowners and operators within the watershed will be encouraged to apply and maintain soil and water conservation measures on their farms and ranches. District-owned equipment will be made available to the landowners and operators in accordance with existing arrangements for equipment usage in the districts. The Soil Conservation Service will provide additional technical assistance to the Jackson County, Harmon County, and Greer County Soil and Water Conservation Districts to assist landowners and operators in accelerating the planning and application of soil, plant, and water conservation measures.

The soil and water conservation loan program of the Farmers Home Administration is available to all eligible farmers and ranchers in the area. Educational meetings will be held in cooperation with other agencies to outline the services available and eligibility requirements. Present FHA clients

will be encouraged to cooperate in the program.

The Oklahoma Department of Wildlife Conservation will assist the Service and the districts by providing technical assistance in planning and application of fish and wildlife habitat development.

The Extension Service will assist with the educational phase of the program by conducting general information and local farm meetings, preparing radio, television, and press releases, and using other methods of getting information to landowners and operators in the watershed.

Structural Measures

Each soil and water conservation district will contract or arrange for the contracting for construction of the floodwater retarding structures and channel improvement within its district as follows:

Harmon County Soil and Water Conservation District - Structures 1, 1A, 2, 2A, 3 through 12, 20, 21, and 4.2 miles of channel improvement.

Greer County Soil and Water Conservation District - Structures 14, 14A, 14B, 14C, 15, 16, 16A, 17 through 19, 29A, 28A, 28B, 28C, and 28D.

Jackson County Soil and Water Conservation District - Structures 13, 22 through 27, 28, 29, 29B, and 9.0 miles of channel improvement.

Land, easements, rights-of-way, and all road, utility, and other improvement relocations required by the structural works of improvement will be provided by the soil and water conservation districts, assisted by the Tri-County Turkey Creek Conservancy District, at no cost to the Federal Government.

Two construction units were determined in which the benefits exceeded cost. One unit includes all sites in Reaches A and B, and the other includes all sites on Russell Hollow (Reach D).

All necessary land, easements, and rights-of-way will be obtained for each construction unit before Federal financial assistance is made available for that unit. All other necessary land, easements, and rights-of-way will be obtained before Federal financial assistance is made available for installation of the remaining structural measures.

Where floodwater retarding structures are in series, the upper structure will be constructed before or concurrently with the lower structure.

Construction of the planned structural measures will be started as soon as project is approved, the contracting agency has funds available and is prepared to discharge its responsibilities, Public Law 566 funds are available,

the necessary easements have been obtained, and operation and maintenance agreements have been executed.

Technical assistance will be provided by the Soil Conservation Service in planning, designing, preparation of specifications, supervision of construction, preparation of contract payment estimates, final inspections, execution of certificates of completion, and related tasks for the establishment of the planned structural measures for flood prevention and sediment reduction. The various features of cooperation between the cooperating parties have been covered in appropriate memoranda of understanding and working agreements.

FINANCING PROJECT INSTALLATION

Federal assistance for carrying out the structural works of improvement and technical assistance for accelerated land treatment as described in this work plan will be provided under the authority of the Watershed Protection and Flood Prevention Act (Public Law 566, 83rd Congress, 68 Stat. 666), as amended.

The County ASC Committees will cooperate with the governing bodies of the soil and water conservation districts by selecting and providing financial assistance for those ASC practices which will accomplish the conservation objectives in the shortest possible time.

The sponsoring organizations recognize their obligations and expected expenses. The Jackson County, Harmon County, and Greer County Soil and Water Conservation Districts and the Tri-County Turkey Creek Conservancy District are legal subdivisions of the State of Oklahoma. They have powers of eminent domain.

Each soil and water conservation district will provide for financing the local share of installation costs within its own district. Contributions of easements, services and monies, and State, county, and watershed revolving funds will be used to the extent possible. When the local sponsors have determined that donated easements and funds obtained by these means are exhausted, they will estimate the additional funds needed to complete the project. The sponsors then may decide to apply for a loan through the Farmers Home Administration.

The Tri-County Turkey Creek Conservancy District will raise the funds needed to complete the project by assessment of benefited landowners. If a loan is obtained from the Farmers Home Administration, the conservancy district will use its powers to assure repayment of the loan.

Federal assistance is contingent upon the local organizations meeting their necessary prior obligations and upon the appropriation and allotments of Federal funds for these purposes.

PROVISIONS FOR OPERATION AND MAINTENANCE

Land Treatment Measures

The land treatment measures on privately owned lands will be operated and maintained by the landowners or operators of the farms and ranches on which the measures are installed under agreements with the Jackson County, Harmon County, and Greer County Soil and Water Conservation Districts. Representatives of the districts will make periodic inspections of the land treatment measures to determine maintenance needs and will encourage landowners and operators to perform needed maintenance. District-owned equipment will be made a vailable for this purpose.

Structural Measures

The 41 floodwater retarding structures and 13.2 miles of channel improvement will be operated and maintained by the Jackson County, Harmon County, and Greer County Soil and Water Conservation District. Each district will be responsible for those structural measures located within the district boundary.

The Tri-County Turkey Creek Conservancy District which has legal authority to raise and expend funds for maintenance purposes will assume joint responsibility to carry out this work.

The estimated average annual operation and maintenance cost of the 41 floodwater retarding structures is $6,100 and for the channel improvement $2,735, based on long-term prices.

The necessary maintenance will be accomplished through the use of contributed labor and equipment, by contract, by force account, or by a combination of these methods. Funds for maintenance will be obtained from revenue drived through assessments by the conservancy district on the benefited lands in the district.

The structural measures will be inspected by representatives of the districts at least annually and after each heavy rain or streamflow. Soil Conservation Service personnel will accompany the district representatives in making inspections at least annually. Items of inspection will include but are not limited to the conditions of the principal spillway and its appurtenances, emergency spillway, earth fill, vegetative cover of the emergency spillway, fences, and gates installed as a part of the floodwater retarding structures. These are items which may need maintenance.

Items of inspection for the 13.2 miles of improved channel will include, but will not be limited to, degree of channel scour, channel filling, bank erosion, obstruction to flow (caused by debris lodged against bridges, fences, and water gates), brush and tree growth within the channel, and the need for control of vegetation or channel clean-out. These are the items in improved

channels which may need maintenance.

The soil and water conservation districts will maintain a record of all maintenance inspections and work done and have it available for inspection by Soil Conservation Service personnel. Provisions will be made for free access of district and Federal representatives to inspect at any time the 41 floodwater retarding structures and 13.2 miles of channel improvement.

The Jackson County, Harmon County, and Greer County Soil and Water Conservation District supervisors fully understand their obligations for maintenance and will execute specific maintenance agreements prior to the issuance of any invitation to bid. Maintenance agreement for channel improvement will include but will not be limited to the annual control of trees, brush and tall grasses by the use of mowing or herbicides. Herbicides used will be those known to be safe to wildlife and domesticated animals.

The Soil Conservation Service, through the Soil and Water Conservation Districts, will participate in the operation and maintenance only to the extent of furnishing technical assistance to aid in inspecting and furnishing technical guidance and information necessary for the operation and maintenance program.

TABLE 1 - ESTIMATED PROJECT INSTALLATION COST

Tri-County Turkey Creek Watershed, Oklahoma

Item	Unit	Number to be Applied 1/	Estimated Cost (Dollars) 3/ Public Law 566 Funds	Other 2/	Total
LAND TREATMENT					
Soil Conservation Service					
Conservation Cropping System	Acre	67,200	-	451,424	451,424
Contour Farming	Acre	16,000	-	9,600	9,600
Cover and Green Manure Crop	Acre	21,000	-	180,600	180,600
Crop Residue Use	Acre	80,600	-	76,570	76,570
Diversions	Mile	35	-	16,310	16,310
Farm Ponds	No.	155	-	93,775	93,775
Fishpond Stocking	No.	90	-	-	-
Grassed Waterways	Acre	92	-	10,304	10,304
Hayland Planting	Acre	5,500	-	107,745	107,745
Irrigation System	No.	75	-	209,232	209,232
Irrigation Water Management	Acre	7,200	-	-	-
Land Leveling	Acre	2,600	-	130,000	130,000
Land Smoothing	Acre	5,400	-	108,000	108,000
Pasture Planting	Acre	1,176	-	11,607	11,607
Pasture Proper Use	Acre	1,780	-	605	605
Range Proper Use	Acre	31,400	-	10,676	10,676
Range Seeding	Acre	7,500	-	93,900	93,900
Stubble Mulching	Acre	9,500	-	19,760	19,760
Terraces	Mile	240	-	44,400	44,400
Wildlife Habitat Development	Acre	650	-	65,000	65,000
Technical Assistance			98,400	56,000	154,400
SCS Subtotal			98,400	1,695,508	1,793,908
TOTAL LAND TREATMENT			98,400	1,695,508	1,793,908
STRUCTURAL MEASURES					
Soil Conservation Service					
Floodwater Retarding Structures	No.	41	2,052,927	-	2,052,927
Channel Improvement	Mile	13.2	200,389	-	200,389
SCS Subtotal			2,253,316	-	2,253,316
Subtotal - Construction			2,253,316	-	2,253,316
Installation Services					
Soil Conservation Service					
Engineering Services			466,609	-	466,609
Other			179,515	-	179,515
SCS Subtotal			646,124	-	646,124
Subtotal - Installation Services			646,124	-	646,124
Other Costs					
Land, Easements, and Rights-of-Way			-	237,599	237,599
Administration of Contracts			-	12,900	12,900
Subtotal - Other			-	250,499	250,499
TOTAL STRUCTURAL MEASURES			2,899,440	250,499	3,149,939
TOTAL PROJECT			2,997,840	1,946,007	4,943,847
SUMMARY					
Subtotal SCS			2,997,840	1,946,007	4,943,847
TOTAL PROJECT			2,997,840	1,946,007	4,943,847

1/ No Federal land involved.

2/ Includes reimbursement from ACPS and other Federal funds under going program.

3/ Price Base - 1962

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TABLE 2 - ESTIMATED STRUCTURE COST DISTRIBUTION

Tri-County Turkey Creek Watershed, Oklahoma
(Dollars) 1/

Structure Site Number	Installation Costs - Public Law 566 Funds				Installation Costs - Other Funds			Total Installation Cost
	Construction	Installation Services		Total Public Law 566	Adm. of Contracts	Easements and R/W	Total Other	
		Engineering	Other					
Floodwater Retarding Structures								
1A	67,030	14,747	5,397	87,174	300	8,637	8,937	96,111
1	101,636	19,311	7,983	128,930	300	19,495	19,795	148,725
2A	25,905	5,699	2,086	33,690	300	2,972	3,272	36,962
2	47,398	10,428	3,816	61,642	300	7,430	7,730	69,372
3	26,934	5,925	2,168	35,027	300	3,240	3,540	38,567
4	21,120	4,646	1,701	27,467	300	1,730	2,030	29,497
5	73,992	14,058	5,811	93,861	300	13,925	14,225	108,086
6	23,760	5,227	1,914	30,901	300	3,828	4,128	35,029
7	32,780	7,212	2,640	42,632	300	6,947	7,247	49,879
8	42,047	9,250	3,386	54,683	300	5,642	5,942	60,625
9	22,770	5,009	1,833	29,612	300	4,920	5,220	34,832
10	109,142	20,737	8,572	138,451	300	14,868	15,168	153,619
11	21,505	4,731	1,732	27,968	300	3,295	3,595	31,563
12	13,001	2,860	1,046	16,907	300	5,295	5,595	22,502
13	24,311	5,348	1,957	31,616	300	2,595	2,895	34,511
14A	55,110	12,124	4,437	71,671	300	1,530	1,830	73,501
14B	47,223	10,389	3,803	61,415	300	4,770	5,070	66,485
14C	51,691	11,372	4,162	67,225	300	1,610	1,910	69,135
14	93,984	17,857	7,382	119,223	300	7,380	7,680	126,903
15	49,905	10,979	4,018	64,902	300	3,520	3,820	68,722
16A	31,746	6,984	2,556	41,286	300	2,470	2,770	44,056
16	94,765	18,005	7,443	120,213	300	5,040	5,340	125,553
17	64,675	14,229	5,208	84,112	300	2,180	2,480	86,592
18	43,862	9,650	3,531	57,043	300	1,160	1,460	58,503

TABLE 2 - ESTIMATED STRUCTURE COST DISTRIBUTION - Continued

Tri-County Turkey Creek Watershed, Oklahoma
(Dollars) 1/

Structure Site Number	Installation Costs - Public Law 566 Funds: Construction	Installation Services: Engineering	Installation Services: Other	Total Public Law 566	Installation Costs - Other Funds: Adm. of Contracts	Easements and R/W	Total Other	Total Installation Cost
Floodwater Retarding Structures								
19	75,790	14,400	5,953	96,143	300	5,140	5,440	101,583
20	25,245	5,554	2,033	32,832	300	2,020	2,320	35,152
21	44,110	9,704	3,551	57,365	300	3,060	3,360	60,725
22	101,838	19,349	7,998	129,185	300	12,270	12,570	141,755
23	32,725	7,200	2,635	42,560	300	2,560	2,860	45,420
24	35,877	7,893	2,889	46,659	300	2,520	2,820	49,479
25	55,378	12,183	4,459	72,020	300	1,940	2,240	74,260
26	46,496	10,229	3,744	60,469	300	13,190	13,490	73,959
27	29,984	6,596	2,414	38,994	300	2,400	2,700	41,694
28A	47,722	10,499	3,843	62,064	300	1,200	1,500	63,564
28B	68,046	14,970	5,479	88,495	300	2,140	2,440	90,935
28C	42,713	9,397	3,439	55,549	300	1,640	1,940	57,489
28D	34,848	7,667	2,806	45,321	300	980	1,280	46,601
28	119,075	22,624	9,352	151,051	300	20,520	20,820	171,871
29A	38,870	8,551	3,130	50,551	300	1,640	1,940	52,491
29B	47,106	10,363	3,793	61,262	300	1,860	2,160	63,422
29	20,812	4,579	1,676	27,067	300	8,760	9,060	36,127
Subtotal	2,052,927	428,535	163,776	2,645,238	12,300	218,319	230,619	2,875,857
Channel Improvement	200,389	38,074	15,739	254,202	600	19,280	19,880	274,082
GRAND TOTAL	2,253,316	466,609	179,515	2,899,440	12,900	237,599	250,499	3,149,939

1/ Price Base - 1962

February 1963

TABLE 3 - STRUCTURE DATA - FLOODWATER RETARDING STRUCTURES

Tri-County Turkey Creek Watershed, Oklahoma

Item	Unit	STRUCTURE NUMBER										
		1	1A	2	2A	3	4	5	6	7	8	9
Drainage Area 1/	Sq.Mi.	16.58 4/	5.39	5.30 4/	2.19	2.24	1.01	8.44	1.28	2.99	1.83	1.63
Storage Capacity 1/												
Sediment Pool	Ac.Ft.	433	135	257	110	147	65	504	88	132	93	95
Sediment in Detention Pool	Ac.Ft.	80	26	45	9	12	5	41	7	24	15	8
Floodwater Detention Pool	Ac.Ft.	1,866	621	636	346	328	163	1,102	195	432	273	254
Total	Ac.Ft.	2,379	782	938	465	487	233	1,647	290	588	381	357
Surface Area 1/												
Sediment Pool	Acre	90	41	55	20	34	17	105	21	33	27	27
Floodwater Detention Pool	Acre	263	123	118	55	78	43	228	46	92	65	56
Volume of Fill	Cu.Yd.	152,300	91,800	81,300	47,100	46,200	38,400	122,300	43,200	59,600	69,500	41,400
Elevation Top of Dam 1/	Foot	1,550.4	1,637.0	1,548.3	1,585.0	1,554.8	1,548.8	1,533.8	1,522.3	1,534.0	1,519.2	1,501.2
Maximum Height of Dam	Foot	35	24	32	27	26	23	23	22	21	26	23
Emergency Spillway												
Crest Elevation 1/	Foot	1,545.4	1,632.0	1,544.3	1,581.0	1,551.3	1,545.8	1,529.3	1,519.3	1,530.5	1,515.7	1,497.7
Bottom Width 1/	Foot	308	230	242	136	104	64	210	92	140	80	78
Type		Veg.	Veg.	Veg.	Veg.	Veg.	Veg.	Veg.	Veg.	Veg.	Veg.	Veg.
Percent Chance of Use 2/		4	4	4	4	4	4	4	4	4	4	4
Average Curve No. - Condition II		73	73	74	73	78	78	77	78	78	78	78
Emergency Spillway Hydrograph												
Storm Rainfall (6-hour)	Inch	4.95	5.29	5.34	5.56	5.55	5.70	5.19	5.66	5.48	5.59	5.62
Storm Runoff	Inch	2.24	2.51	2.64	2.73	3.20	3.32	2.78	3.29	3.13	3.23	3.26
Velocity of Flow (V_c) 3/	Ft./Sec.	2.8	2.7	3.0	0	2.7	2.2	3.0	2.7	3.2	2.7	2.5
Discharge Rate 3/	C.F.S.	66	154	160	0	82	21	134	67	83	63	45
Maximum Water Surface Elevation 3/	Foot	1,545.8	1,632.4	1,544.8	-	1,551.7	1,546.0	1,529.8	1,519.7	1,531.0	1,516.1	1,498.0
Freeboard Hydrograph												
Storm Rainfall (6-hour)	Inch	10.20	13.75	10.78	14.43	11.42	11.74	10.69	11.64	11.30	11.51	11.58
Storm Runoff	Inch	6.81	10.14	7.58	10.79	8.63	8.94	7.78	8.84	8.52	8.72	8.78
Velocity of Flow (V_c) 3/	Ft./Sec.	9.8	9.7	8.8	8.6	8.1	7.6	9.5	7.4	7.9	8.1	8.1
Discharge Rate 3/	C.F.S.	8,679	6,481	4,755	2,653	1,665	796	5,335	1,144	2,165	1,330	1,224
Maximum Water Surface Elevation 3/	Foot	1,550.4	1,637.0	1,548.3	1,585.0	1,554.8	1,548.8	1,533.8	1,522.3	1,534.0	1,519.2	1,501.2
Principal Spillway												
Capacity - Low Stage	C.F.S.	220	54	71	18	23	8	85	13	30	19	13
Crest Elevation 1/	Foot	1,534.3	1,623.6	1,536.8	1,571.5	1,545.3	1,540.3	1,522.5	1,513.3	1,523.3	1,509.6	1,491.3
Capacity Equivalents												
Sediment Volume	Inch	0.49	0.47	0.91	0.94	1.23	1.21	1.12	1.29	0.83	0.95	1.10
Sediment in Detention Pool	Inch	0.09	0.09	0.16	0.08	0.10	0.09	0.09	0.10	0.15	0.16	0.09
Floodwater Detention Volume	Inch	2.11	2.16	2.25	2.96	2.75	3.03	2.45	2.85	2.71	2.80	2.93
Spillway Storage	Inch	1.87	2.66	1.98	2.10	2.52	2.67	2.54	2.18	2.29	2.49	2.70
Class of Structure		A	A	A	A	A	A	A	A	A	A	A

(See Footnotes last page, Table 3.)

TABLE 3 - STRUCTURE DATA - FLOODWATER RETARDING STRUCTURES - Continued
Tri-County Turkey Creek Watershed, Oklahoma

Item	Unit	STRUCTURE NUMBER										
		10	11	12	13	14	14A	14B	14C	15	16	16A
Drainage Area 1/	Sq.Mi.	9.75	1.34	0.80	0.92	5.69 4/	2.16	2.90	1.14	2.59	5.62 4/	1.50
Storage Capacity 1/												
Sediment Pool	Ac.Ft.	640	82	48	54	176	48	67	54	83	240	53
Sediment in Detention Pool	Ac.Ft.	52	6	4	4	61	8	12	10	15	45	9
Floodwater Detention Pool	Ac.Ft.	1,378	212	129	143	762	254	346	182	322	728	211
Total	Ac.Ft.	2,070	300	181	201	999	310	425	246	420	1,013	273
Surface Area 1/												
Sediment Pool	Acre	113	20	16	15	40	12	21	13	27	43	11
Floodwater Detention Pool	Acre	235	45	33	39	138	35	82	38	66	134	39
Volume of Fill	Cu.Yd.	180,400	39,100	22,300	41,700	120,400	82,500	81,000	69,600	85,600	172,300	55,500
Elevation Top of Dam 1/	Foot	1,501.4	1,477.4	1,469.8	1,509.2	1,536.0	1,650.2	1,593.9	1,597.6	1,552.2	1,534.2	1,585.7
Maximum Height of Dam	Foot	31	25	20	21	30	28	19	24	24	33	35
Emergency Spillway												
Crest Elevation 1/	Foot	1,497.4	1,474.4	1,466.8	1,506.2	1,532.0	1,646.2	1,589.9	1,593.6	1,548.7	1,529.7	1,581.7
Bottom Width 1/	Foot	296	96	58	60	370	164	144	90	142	250	150
Type		Veg.	Veg.	Veg.	Veg.	Veg.	Veg.	Veg.	Veg.	Veg.	Veg.	Veg.
Percent Chance of Use 2/		4	4	4	4	4	4	4	4	4	4	4
Average Curve No. - Condition II		78	78	78	78	77	71	73	78	77	76	76
Emergency Spillway Hydrograph												
Storm Rainfall (6-hour)	Inch	5.14	5.65	5.73	5.71	5.33	5.55	5.49	5.68	5.53	5.33	5.63
Storm Runoff	Inch	2.84	3.28	3.35	3.33	2.90	2.54	2.67	3.30	3.07	2.81	3.06
Velocity of Flow (V_c) 3/	Ft./Sec.	2.5	2.5	2.5	2.7	3.0	2.8	2.8	2.8	3.5	3.0	3.2
Discharge Rate 3/	C.F.S.	151	39	14	40	188	93	12	38	188	196	116
Maximum Water Surface Elevation 3/	Foot	1,497.7	1,474.7	1,467.1	1,506.6	1,532.5	1,646.6	1,590.3	1,593.9	1,549.5	1,530.2	1,582.3
Freeboard Hydrograph												
Storm Rainfall (6-hour)	Inch	10.60	11.63	11.80	11.77	10.42	14.43	14.27	14.77	11.38	10.70	14.63
Storm Runoff	Inch	7.84	8.83	8.99	8.96	7.53	10.47	10.63	11.86	8.44	7.66	11.42
Velocity of Flow (V_c) 3/	Ft./Sec.	9.8	7.3	7.3	7.4	9.0	8.7	8.8	8.8	8.2	9.4	8.8
Discharge Rate 3/	C.F.S.	5,776	1,165	703	730	7,784	3,100	2,868	1,775	2,293	6,138	3,004
Maximum Water Surface Elevation 3/	Foot	1,501.4	1,477.4	1,469.8	1,509.2	1,536.0	1,650.2	1,593.9	1,597.6	1,552.2	1,534.2	1,585.7
Principal Spillway												
Capacity - Low Stage	C.F.S.	78	11	7	10	114	18	29	10	31	72	15
Crest Elevation 1/	Foot	1,489.2	1,467.6	1,461.2	1,500.8	1,522.0	1,633.7	1,582.5	1,585.6	1,541.4	1,520.8	1,569.3
Capacity Equivalents												
Sediment Volume	Inch	1.23	1.15	1.13	1.10	0.58	0.42	0.43	0.89	0.60	0.80	0.66
Sediment in Detention Pool	Inch	0.10	0.08	0.09	0.08	0.20	0.07	0.08	0.16	0.11	0.15	0.13
Floodwater Detention Volume	Inch	2.65	2.97	3.03	2.91	2.51	2.21	2.24	3.00	2.33	2.43	2.64
Spillway Storage	Inch	2.52	2.05	2.35	2.86	2.02	1.72	2.55	3.08	1.96	2.84	1.65
Class of Structure		A	A	A	A	A	A	A	A	A	A	A

(See Footnotes last page, Table 3.)

TABLE 3 - STRUCTURE DATA - FLOODWATER RETARDING STRUCTURES - Continued
Tri-County Turkey Creek Watershed, Oklahoma

Item	Unit	STRUCTURE NUMBER 17	18	19	20	21	22	23	24	25	26	27
Drainage Area 1/	Sq.Mi.	2.67	0.87	4.47	1.97	2.64	13.89	1.77	1.36	1.61	10.07	1.65
Storage Capacity 1/												
Sediment Pool	Ac.Ft.	104	37	246	71	110	674	71	69	107	564	95
Sediment in Detention Pool	Ac.Ft.	20	3	31	5	9	52	5	5	8	43	7
Floodwater Detention Pool	Ac.Ft.	334	140	587	292	384	1,748	275	201	207	1,214	240
Total	Ac.Ft.	458	180	864	368	503	2,474	351	275	322	1,821	342
Surface Area 1/												
Sediment Pool	Acre	16	10	40	20	30	118	23	24	21	112	24
Floodwater Detention Pool	Acre	54	26	99	53	83	272	78	72	51	235	66
Volume of Fill	Cu.Yd.	106,900	72,500	132,500	45,900	80,200	154,300	59,500	59,300	86,800	87,300	46,200
Elevation Top of Dam 1/	Foot	1,546.4	1,561.8	1,549.2	1,486.7	1,490.0	1,477.7	1,479.6	1,465.3	1,403.8	1,413.9	1,418.0
Maximum Height of Dam	Foot	38	22	33	23	25	32	20	14	33	32	26
Emergency Spillway												
Crest Elevation 1/	Foot	1,542.9	1,558.8	1,545.2	1.483.2	1,486.5	1,472.7	1,476.6	1,462.3	1,400.8	1,408.9	1,415.0
Bottom Width 1/	Foot	138	68	118	108	122	334	100	52	112	160	106
Type		Veg.	Veg.	Veg.	Veg.	Veg.	Veg.	Veg.	Veg.	Veg.	Veg.	Veg.
Percent Chance of Use 2/		4	4	4	4	4	4	4	4	4	4	4
Average Curve No. - Condition II		74	78	76	78	78	78	78	76	75	75	76
Emergency Spillway Hydrograph												
Storm Rainfall (6-hour)	Inch	5.51	5.72	5.40	5.57	5.51	5.00	5.60	5.65	5.62	5.10	5.61
Storm Runoff	Inch	2.79	3.34	2.87	3.21	3.16	2.72	3.24	3.08	2.96	2.52	3.05
Velocity of Flow (V_c) 3/	Ft./Sec.	3.2	3.0	3.2	3.0	3.0	3.2	2.8	2.8	3.0	3.0	2.8
Discharge Rate 3/	C.F.S.	98	23	96	71	58	353	30	26	80	105	24
Maximum Water Surface Elevation 3/	Foot	1,543.5	1,559.1	1,545.8	1,483.7	1,487.0	1,473.3	1,476.9	1,462.6	1,401.3	1,409.4	1,415.3
Freeboard Hydrograph												
Storm Rainfall (6-hour)	Inch	11.36	11.78	11.11	11.48	11.35	10.91	11.53	11.63	11.57	10.51	11.56
Storm Runoff	Inch	8.03	8.97	8.05	8.69	8.57	8.14	8.74	8.54	8.35	7.35	8.47
Velocity of Flow (V_c) 3/	Ft./Sec.	8.1	7.3	8.7	8.1	8.1	10.1	7.3	7.4	7.5	9.9	7.4
Discharge Rate 3/	C.F.S.	2,141	810	2,319	1,686	1,916	10,058	1,178	644	1,396	4,625	1,293
Maximum Water Surface Elevation 3/	Foot	1,546.4	1,561.8	1,549.2	1,486.7	1,490.0	1,477.7	1,479.6	1,465.3	1,403.8	1,413.9	1,418.0
Principal Spillway												
Capacity - Low Stage	C.F.S.	27	7	45	20	27	167	15	11	20	100	14
Crest Elevation 1/	Foot	1,532.0	1,550.5	1,535.8	1,474.7	1,479.3	1,463.5	1,470.7	1,457.5	1,395.0	1,401.5	1,409.2
Capacity Equivalents												
Sediment Volume	Inch	0.73	0.80	1.03	0.68	0.78	0.91	0.75	0.95	1.25	1.05	1.08
Sediment in Detention Pool	Inch	0.14	0.07	0.13	0.05	0.06	0.07	0.05	0.07	0.09	0.08	0.08
Floodwater Detention Volume	Inch	2.35	3.03	2.46	2.78	2.73	2.36	2.92	2.77	2.41	2.26	2.73
Spillway Storage	Inch	1.63	2.00	2.83	2.11	2.49	2.09	2.98	3.71	2.12	2.86	2.51
Class of Structure		A	A	A	A	A	A	A	A	A	A	A

(See Footnotes last page, Table 3.)

TABLE 3 - STRUCTURE DATA - FLOODWATER RETARDING STRUCTURES - Continued

Tri-County Turkey Creek Watershed, Oklahoma

Item	Unit	STRUCTURE NUMBER 28	28A	28B	28C	28D	29	29A	29B	Total
Drainage Area 1/	Sq.Mi.	4/30.62	1.46	3.49	1.75	1.09	4/ 9.58	1.17	1.42	176.84
Storage Capacity 1/										
Sediment Pool	Ac.Ft.	800	57	128	69	45	307	48	94	7,300
Sediment in Detention Pool	Ac.Ft.	49	4	9	6	3	20	4	8	789
Floodwater Detention Pool	Ac.Ft.	2,189	215	523	265	175	941	186	223	21,222
Total	Ac.Ft.	3,038	276	660	340	223	1,268	238	325	29,311
Surface Area 1/										
Sediment Pool	Acre	140	16	28	23	12	70	14	29	1,571
Floodwater Detention Pool	Acre	375	40	75	55	33	176	39	60	3,993
Volume of Fill	Cu.Yd.	115,000	74,800	103,100	70,600	57,600	34,400	63,100	80,800	3,274,300
Elevation Top of Dam 1/	Foot	1,378.9	1,522.5	1,570.7	1,552.3	1,548.0	1,420.0	1,505.8	1,475.3	xxx
Maximum Height of Dam	Foot	29	23	31	20	24	32	21	19	xxx
Emergency Spillway										
Crest Elevation 1/	Foot	1,376.2	1,519.5	1,566.7	1,549.3	1,545.0	1,415.0	1,501.8	1,471.3	xxx
Bottom Width 1/	Foot	700	114	128	130	92	262	94	68	xxx
Type		Veg.	Veg.	Veg.	Veg.	Veg.	Veg.	Veg.	Veg.	xxx
Percent Chance of Use 2/	-	4	4	4	4	4	4	4	4	xxx
Average Curve No. -Condition II	-	78	76	74	77	78	74	78	78	xxx
Emergency Spillway Hydrograph										
Storm Rainfall (6-hour)	Inch	7.87	5.64	5.45	5.59	5.69	5.14	5.66	5.64	xxx
Storm Runoff	Inch	5.04	3.07	2.74	3.12	3.31	2.48	3.29	3.27	xxx
Velocity of Flow (Vc) 3/	Ft./Sec.	4.8	2.8	0	2.8	2.8	4.0	2.8	2.8	xxx
Discharge Rate 3/	c.f.s.	4,700	46	0	46	33	483	35	10	xxx
Maximum Water Surface Elev. 3/	Foot	1,377.6	1,519.8	-	1,549.6	1,545.3	1,416.0	1,502.1	1,471.6	xxx
Freeboard Hydrograph										
Storm Rainfall (6-hour)	Inch	10.50	11.62	11.23	11.52	11.72	10.59	14.73	14.66	xxx
Storm Runoff	Inch	7.75	8.53	7.92	8.57	8.92	7.29	11.83	11.76	xxx
Velocity of Flow (Vc) 3/	Ft./Sec.	8.1	7.4	8.7	7.4	7.3	9.9	8.8	8.8	xxx
Discharge Rate 3/	c.f.s.	9,500	1,412	2,513	1,608	1,101	7,625	1,841	1,345	xxx
Maximum Water Surface Elev. 3/	Foot	1,378.9	1,522.5	1,570.7	1,552.3	1,548.0	1,420.0	1,505.8	1,475.3	xxx
Principal Spillway										
Capacity - Low Stage	c.f.s.	2,127	12	28	14	9	166	10	12	xxx
Crest Elevation 1/	Foot	1,367.1	1,511.2	1,556.4	1,542.5	1,537.0	1,406.6	1,494.6	1,466.2	xxx
Capacity Equivalents										
Sediment Volume	Inch	0.49	0.74	0.69	0.74	0.77	0.60	0.77	1.25	xxx
Sediment in Detention Pool	Inch	0.03	0.05	0.05	0.06	0.05	0.04	0.06	0.11	xxx
Floodwater Detention Volume	Inch	1.34	2.76	2.81	2.83	3.01	1.84	2.98	2.96	xxx
Spillway Storage	Inch	0.72	1.74	1.75	1.89	1.93	1.92	3.09	4.32	xxx
Class of Structure		B	A	A	A	A	A	A	A	xxx

1/ May require slight adjustment in final design.
2/ Based on regional analysis of gaged runoff. All structures exceed minimum requirements of Engineering Memorandum SCS-27 and in accordance with Engineering Memorandum OK-22 (Rev.4).
3/ Maximum during passage of hydrograph.
4/ Excluding the area from which runoff is controlled by other structures.

February 1963

TABLE 3A - STRUCTURE DATA

CHANNELS

Tri-County Turkey Creek Watershed, Oklahoma

Channel Designation	Station Numbering for Reach 1/ Station (100 ft.)	Station (100 ft.)	Watershed Area 2/ (sq.mi.)	Planned Channel Capacity 3/ (cfs)	Average Bottom Width (feet)	Side Slope (ratio)	Average Depth of Flow (feet)	Average Slope of Bottom (ft./ft.)	Average Velocity at Designed Depth (ft./sec.)	Volume of Excavation (1,000 cu. yds.)
Reach A										
Turkey Creek	0+00	30+00	2.23	450	18	2:1	4.8	.0020	3.7	13.7
	30+00	57+00	2.23	450	20	2:1	4.5	.0020	3.7	17.9
	57+00	60+00	3.71	520	22	2:1	4.5	.0020	3.7	1.7
	60+00	123+00	4.71	580	25	2:1	4.5	.0020	3.8	27.4
County Road	123+00	170+50	6.48	670	26	2:1	4.6	.0023	4.0	23.0
	170+50	222+00	8.40	750	26	2:1	4.8	.0027	4.4	39.5
Total Reach A										123.2
Reach D										
Russell Hollow	0+00	30+00	5.60	650	32	2:1	4.0	.0027	4.2	8.9
County Road	51+00									
	62+00									
	30+00	85+00	7.70	800	36	2:1	4.0	.0027	4.3	25.5
County Road	119+00									
	85+00	144+00	10.20	1,000	42	2:1	4.2	.0027	4.4	38.5
	144+00	150+00	10.20	1,000	46	2:1	4.5	.0027	4.3	5.1
County Road	175+00									
	150+00	211+50	12.00	1,100	49	2:1	4.5	.0024	4.3	70.0
Intersection w/tributary A	213+50									
County Road	269+00									
County Road	282+00									
	213+50	320+00	26.00	1,980	60	2:1	6.0	.0020	5.0	208.9
Subtotal										356.9
Lateral A	0+00A	24+00A	5.60	650	30	2:1	4.2	.0019	4.1	13.3
	24+00A	49+50A	5.60	660	30	2:1	4.0	.0032	4.3	16.6
	49+50A	72+00A	5.60	670	32	2:1	4.0	.0025	4.3	14.8
Intersection w/tributary B	72+00A									
	72+00A	117+00A	11.10	1,070	50	2:1	4.0	.0032	4.8	58.8
Intersection w/main stem	119+00A									
Subtotal										103.5
Lateral B	0+00B	36+00B	4.50	550	40	2:1	3.0	.0040	4.4	22.8
Intersection w/tributary A	37+00B									
Total Reach D										483.2

1/ Station numbering begins upstream.
2/ Uncontrolled drainage area for reach.
3/ Channel is designed for peak flow from runoff for a 24-hour, 5-year frequency storm plus release flow from structures.
Total Length of Channel Improvement = 13.2 miles; Total Excavation = 606,400 cubic yards.

February 1963

TABLE 4 - ANNUAL COST

Tri-County Turkey Creek Watershed, Oklahoma

(Dollars)

Evaluation Unit	Amortization of Installation Cost 1/	Operation and Maintenance Cost 2/	Total
Floodwater Retarding Structures			
1, 1A, 2, 2A, 3 through 14, 14A, 14B, 14C, 15, 16, 16A, 17 through 28, 28A, 28B, 28C, 28D, 29, 29A, 29B, and 13.2 miles of Channel Improvement	119,540	8,835	128,375
Total	119,540	8,835	128,375

1/ Price Base: 1962 installation cost amortized for 50 years at 2-7/8 percent.

2/ Long-term prices, as projected by ARS, September 1957.

February 1963

TABLE 5 - ESTIMATED AVERAGE ANNUAL FLOOD DAMAGE REDUCTION BENEFITS

Tri-County Turkey Creek Watershed, Oklahoma
(Dollars) 1/

Item	Estimated Average Annual Damage: Without Project	Estimated Average Annual Damage: With Project	Damage Reduction Benefit
Floodwater			
Crop and Pasture	143,393	15,192	128,201
Other Agricultural	18,818	3,780	15,038
Nonagricultural (Roads, Bridges, etc.)	24,888	6,139	18,749
Subtotal	187,099	25,111	161,988
Sediment			
Overbank Deposition	28,826	8,645	20,181
Erosion			
Flood Plain Scour	11,235	1,291	9,944
Indirect	22,716	3,505	19,211
Total	249,876	38,552	211,324

1/ Price Base: Long-Term, as projected by ARS, September 1957.

February 1963

TABLE 6 - COMPARISON OF BENEFITS AND COSTS FOR STRUCTURAL MEASURES

Tri-County Turkey Creek Watershed, Oklahoma
(Dollars)

Evaluation Unit	Average Annual Benefits 1/ — Flood Prevention: Damage Reduction	Average Annual Benefits 1/ — Flood Prevention: More Intensive Land Use	Average Annual Benefits 1/ — Secondary Benefits	Average Annual Benefits 1/ — Total	Average Annual Cost 2/	Benefit-Cost Ratio
41 Floodwater Retarding Structures in Combination with 13.2 Miles of Channel Improvement	202,871	65,190	26,444	294,505	128,375	2.3:1
Grand Total 3/	202,871	65,190	26,444	294,505	128,375	2.3:1

1/ Benefits - long-term price base as projected by ARS, September 1957.

2/ From Table 4.

3/ In addition, it is estimated that land treatment measures will provide flood damage reduction benefits of $8,453 annually.

February 1963

TABLE 7 - CONSTRUCTION UNITS

Tri-County Turkey Creek Watershed, Oklahoma
(Dollars)

Measures Construction Unit	Annual Benefit 1/	Annual Cost 2/
Floodwater Retarding Structures		
1, 1A, 2, 2A, 3 through 13, in Combination with 4.2 miles of Channel Improvement	90,825	41,039
Floodwater Retarding Structures		
14,14A, 14B, 14C, 15, 16, 16A, 17 through 19, in Combination with 9 miles of Channel Improvement	108,598	43,003

1/ Price Base: Long-term prices as projected by ARS, September 1957.

2/ Derived from amortized installation costs based on 1962 price levels and operation and maintenance costs based on long-term prices as projected by ARS, September 1957.

February 1963

INVESTIGATIONS AND ANALYSES

Project Formulation

Land Treatment Measures

Soil-Cover Conditions

Estimates of the soil-cover conditions were made from existing work unit records, soil surveys, study of geologic formations, and a sampling of types of cover existing in various problem areas. Data covering land use of the flood plain were developed during economic investigations.

Land Treatment Needs

The current conservation needs were based on estimates by local Soil Conservation Service technicians from records of basic conservation plans and county inventories. Further adjustments were made using the soil-cover complex information. From these needs and based on local experience, an estimate was made of the measures that could be applied during the 8-year installation period. The quantities and cost of these measures are shown in table 1. Although these needed land treatment measures would have an effect in flood damage reduction, it was apparent that structural measures would be required to attain the degree of flood protection desired.

Structural Measures

After considering the effect of the land treatment measures, a determination was made of structural measures for flood prevention. These studies were as follows:

1. A base map of the watershed was prepared showing the watershed boundary, drainage pattern, system of roads and other pertinent information. A stereoscopic study of consecutive 4-inch aerial photographs was used to locate possible floodwater retarding structure sites, the limits and area of the flood plain and the points where valley cross sections should be taken to determine hydraulic characteristics and for flood routing purposes. This information was placed on the watershed base map for use in field surveys. Cross sections of the flood plain were surveyed at the selected locations (figure 4). Data developed from these cross sections permitted the computation of peak discharge-damage relationships for various flood flows. A map was prepared of the flood plain on which land use, cross-section locations and other pertinent information were recorded.

2. A field examination was made of all possible floodwater retarding structure sites previously located stereoscopically. Sites which did not show good storage possibilities or which would inundate highways or expensive improvements, for which relocation

was not economically feasible, were dropped from further consideration. A system of floodwater retarding structures was selected from the remaining sites for further consideration and detailed survey. Plans of a floodwater retarding structure, typical of those planned for the watershed, are illustrated by figures 2 and 2A.

3. A topographic map was made of the pool area of each proposed floodwater retarding structure site to determine the storage capacity of the site, the estimated cost of the dam and the areas of flood plain and upland that would be inundated by the sediment and detention pools. The heights of the dams and the sizes of the pools were determined by the criteria outlined in Oklahoma Engineering Memorandum OK-22, Revised May 1960. The limits of the detention and sediment pools of all satisfactory sites and the limits of the flood plain were located on a copy of the base map. Structure data tables were developed to show the drainage area for each structure, the storage capacity needed for floodwater detention and for sediment storage in acre-feet and in inches of runoff from the drainage areas, the release rate of the principal spillway, the acres inundated by the sediment and detention pools, and the other pertinent data (tables 2 and 3). The emergency spillways were proportioned by using a factor times the 6-hour rainfall as shown on figure 3.21-1 Soil Conservation Service, National Engineering Handbook, Section 4, Hydrology, Supplement A. The factors used are as follows: Class (a) structures: 1.03 x 6-hour storm; Class (a) structures in series with class (a) structures: 1.30 x 6-hour storm; Class (b) (Structure 28): 1.25 x 6-hour storm.

4. Damages resulting from floodwater, sediment, and erosion were determined from damage schedules and surveys of the flood plain area. Reduction in these damages by the installation of floodwater retarding structures was estimated on the basis of reduction of area inundated, time of inundation and depth as determined by flood routings. When it became evident that floodwater retarding structures would not give the desired level of protection to the flood plain, consideration was given to the need for channel improvement. Additional representative channel cross sections were selected and surveyed to aid in channel alignment and in determining the size and cost of improving the channel. The design of the channel was based on the peak runoff expected from a 5-year frequency storm plus release flows from proposed structures (table 3A).

5. Flood damages were calculated using flood routings under non-project conditions and future conditions after proposed

works of improvement had been installed. Alternate systems of structural measures were evaluated, and the combination was selected which met project objectives at lowest cost.

6. The combined project for flood prevention, including land treatment measures, floodwater retarding structures and channel improvement, was evaluated. Studies were made and data developed to show the total cost of each type of measure and the portion of the cost to be borne by each participant. A summation of the total costs for all planned measures is shown in table 1. A second cost table was developed to show the annual installation cost, annual maintenance cost, and total annual cost of the structural measures (table 4).

Hydraulic and Hydrologic Investigations

The following steps were taken as a part of the hydraulic and hydrologic investigations and determinations:

1. Basic meteorologic and hydrologic data were tabulated from Climatological Bulletins, U. S. Weather Bureau, and Water Supply Papers, U. S. Geological Survey, and analyzed to determine average seasonal distribution of precipitation, depth-duration relationships, frequency of occurrence of meteorological events to be used in the evaluation of the project, rainfall-runoff relationships, runoff-peak discharge relationships, and the relationship of geology, soils, and climate to runoff depth for single-storm events.

2. Engineering surveys were made of channel and valley cross sections selected to represent adequately the stream hydraulics and flood plain area. Preliminary locations for cross sections were made by stereoscopic examination of aerial photographs of the flood plain. The final locations were selected on the ground, giving due consideration to the needs of the economist and geologist. The evaluation reaches were delineated in conference with the economist and geologist.

3. The present hydrologic condition of the watershed was based on the soil-cover determinations. The future hydrologic condition was determined by obtaining from the work unit conservationists the changes in land use that could be expected with an accelerated land treatment program during the installation period. Runoff curve numbers were computed from the soil-cover complex data and used with figure 3.10-1, Soil Conservation Service National Engineering Handbook, Section 4, Supplement A, to determine the depth of runoff from storms in the synthetic storm series.

4. Cross-section rating curves were computed from field survey data collected, as described in item 2, above, by solving water-surface profiles for various discharges. The water-surface profiles were computed by the Doubt method described on pages 3.14-7 to 13, NEH, Section 4, Supplement A.

5. The relationships of peak discharge to drainage area were determined by stream routing hydrographs representing the 2-year, 10-year, and 25-year frequency, 24-hour duration storms for present conditions and for conditions which will exist after full functioning of the project. The storm rainfall amounts were in conformity with those established for a range of frequencies in Weather Bureau Technical Paper Number 40. The hydrographs were computed by the method presented in NEH, Section 4, Supplement A, part 3.21. The hydrographs were routed from the source to the mouth of the stream (by sub-reaches) using the Improved Coefficient Method found in revised Chapter 17 of Section 4, NEH, Supplement A.

6. Stage-area inundation curves were developed for each sub-reach of the stream. Flooded areas by increments of depth and duration of inundation were tabulated for the 2, 10, and 25-year frequency, 24-hour duration storms for both present conditions and conditions with the project in place. The area inundated by time increments was scaled from the routed hydrographs for each stream reach. A log-probability analysis of the damages computed from these tabulations was made for each reach.

7. After a study of the hydraulic and hydrologic characteristics, topography, and geology of this watershed, and the types of damages occurring, it was determined that the annual flood frequency method should be used for the analysis.

8. The relationship between damage and frequency was determined for conditions which would exist due to:

    a. The present conditions of the watershed remaining static.

    b. The installation of land treatment measures for watershed protection.

    c. The installation of land treatment measures, floodwater retarding structures and channel improvement.

9. A depth-frequency curve of 24-hour precipitation was prepared by log-probability analysis of precipitation data in Weather Bureau Technical Paper 40. A storm which would yield a runoff of 3.12

inches was found to be the 24-hour, 25-year frequency storm. This amount of runoff was routed to determine the maximum flood plain area for the computation of flood damage.

10. The appropriate spillway design storm and storm pattern were selected from figures 3.21-1, 3.21-4 and 5, NEH, Section 4, Supplement A, in accordance with criteria contained in Engineering Memorandum SCS-27 (OK-22).

11. Spillway design storm hydrographs were developed for each of the floodwater retarding structures by the distribution graph method. The combination of emergency spillway width, depth, and elevation for the most economical structure was estimated by an empirical equation. The final design was obtained by the Goodrich flood routing method described on page 5.8-12 of NEH, Section 5, for all sites in series and sites having special design problems.

12. For channel improvement, the channel capacity requirement was found to be that which would discharge the peak runoff from the 24-hour, 5-year frequency storm from the uncontrolled watershed area, plus the release from structures.

13. The surface runoff of 3.12 inches from the 24-hour, 25-year frequency storm would cause a peak discharge of 20,500 cfs at the reference valley section 4A. After the installation and full functioning of the measures proposed in this plan, surface runoff would be reduced to 3.02 inches and peak discharge to 9,400 cfs at the same reference valley section.

Sedimentation Investigations

Field procedures used in the investigation of sedimentation problems were made in accordance with the Oklahoma Planning Handbook, Geology Section III, and Technical Release No. 12. This included field examinations along valley cross sections to locate areas of damaging overbank deposition and flood plain scour. Borings were made along or near 80 percent of the cross sections to determine the character and thickness of sediment deposits. Conditions of the stream beds and banks also were noted. In preparation of the work plan, tabular summaries of the above findings, along with explanatory text, were prepared and used by the economist as a basis for calculating monetary damages and benefits.

Sediment Source Studies

Detailed and semi-detailed surveys of sediment sources were made on drainage areas above all proposed floodwater retarding structures to determine the annual rate of gross erosion. Land subdivisions on a basis of soil units, percent and length of slope, land use, and cover

conditions were examined separately and planimetered for calculation of erosion rates. Sediment derived from road and gully erosion was estimated from field studies. From these studies and from a sedimentation survey made on a small lake in Harmon County, the volume of sediment that will be deposited in each structure during the 50-year design storage period was calculated.

The total annual volume of sediment delivered to all sites was calculated to be 124 acre-feet, of which 112 acre-feet are from sheet erosion and 12 acre-feet from road and channel erosion. The total volume required for sediment accumulation in all floodwater retarding structures is 8,089 acre-feet. The average annual rate of deposition in the structures ranges from 0.52 acre-foot to 1.45 acre-feet per square mile. The principal source of sediment is from sheet erosion on cultivated land. Approximately 90 percent of the total sediment produced above the proposed structures is derived from sheet erosion.

Geologic Investigations

The surface formations of the watershed are of the Permian system capped across the northern boundary by sands and alluvium of Quaternary age. The Permian formations exposed from east to west consist of the Flowerpot shale, Blaine formation, Dog Creek shale, and the Whitehorse group. These formations are principally clayey and silty gypsiferous shales with variable beds of dolomite, siltstone, and gypsum.

The Blaine formation is characterized and distinguished by a sequence of gypsum, dolomite, and shale beds. The gypsum beds are massive, range from 6 to 20 feet in thickness and contain many solution channels and cavities. In the vicinity of Duke, the close proximity of these beds to the surface is indicated by sinkholes. Although there are local variations, the regional dip of the formation is to the southwest at the approximate rate of 30-40 feet per mile.

A classification of proposed structure sites by geologic formations is:

		Sites
Flowerpot Shale	-	28
Blaine Formation	-	17-19, 24-27, 28A, 28B, 28C, 28D, 29, 29A, 29B
Dog Creek Shale	-	3-13, 20-23
Dog Creek Shale and Quaternary	-	1, 1A, 2, 2A, 14, 14B, 14C, 15, 16, 16A
Quaternary	-	14A

Semi-detailed geologic investigations were made of proposed structure site locations 28, 28B, 29, 5, and 10, using powered drilling equipment. Samples were taken for laboratory testing. Preliminary geologic investigations were made of the remaining site locations.

Increased costs as a result of these geologic conditions which affect design and construction measures have been taken into consideration in arriving at total construction costs. Costs of detailed investigations of sites with laboratory services also will be affected.

Rock excavation is expected to be minor. Site 29 is the only site considered to have significant rock excavation due to massive gypsum beds in the abutments.

Water table levels are deep on most sites. The few sites with wet conditions in the alluvial areas are 1A, 14, 14C, 16, and 28B. Auxilary borrow areas may be required on these sites.

Semi-detailed investigations were made to determine the general stability of the proposed channel. Laboratory analyses were made to determine particle size distribution, plasticity indices and dispersion ratios. Preliminary analysis of these data, using the tractive force approach, indicates that degradation of the channel may occur in one reach and may require the installation of some type of grade control structure. Further detailed studies and analyses of this problem will be made prior to final design and construction of the channel improvement works.

Economic Investigations

Selection of Evaluation Reaches

Because of the diversity of damageable values and flood plain characteristics, the flood plain was divided into five evaluation reaches (figure 4).

Damage schedules covering 53 percent of the flood plain were obtained from landowners and operators in the area. These schedules covered land use and crop distribution, yield data, and historical information on flooding and flood damages. Analysis of the information contained in the schedules and supplemental data from other similar watersheds formed the basis of determining damage rates for depth and duration of flooding. Since the frequency rainfall series was used, it was necessary to use a weighted damage rate by weighting the frequency of storms by months to determine the annual damage for a given size storm occurring at any time of the year. Schedules indicated that duration of inundation was a factor in determining the damage to crops and pastures. Preliminary information from the Engineering and Watershed Planning Unit at Fort Worth, Texas, relating duration of flooding to damage rates was correlated with information taken from schedules and experience gained from planning other similar watersheds to establish damage rates for each crop by the length of time in hours of inundation. The monetary damage arrived at in this work plan is that arrived at by using acres flooded by depth times the percentage damage done by different hours of inundation. The damages for the 2-year, 10-year, and the 25-year frequency storms were then plotted on log-probability paper to arrive at damages for all storms in the series.

Damage to other agricultural property, such as fences, levees, dikes, irrigation systems, livestock, and farm equipment, was obtained from analysis of schedules and correlated with the amount of peak runoff for the rains in the series.

Data on non-agricultural damage occurring to roads and bridges were obtained from residents and county commissioners. The indirect damages consisted primarily of the extra travel time to market, interrupted travel, late deliveries, loss of business, and loss of employment. Upon analysis, it appeared that indirect damage amounted to at least 10 percent of the direct damage.

Floodwater, erosion, and sediment damage on the flood plain was calculated under non-project conditions, under those which will prevail after installation of land treatment measures, and under conditions after installation of both land treatment and structural measures included in the proposed project. Crop and pasture damage was adjusted to allow for the effect of recurring flooding. A ten percent reduction in damages under non-project conditions and after land treatment was used for crop and pasture damages for recurrence. Experience gained in planning similar watersheds using the historical series indicated that percent as an average. No adjustment was made for recurrence under project conditions. The difference between average annual damage with only land treatment measures established and that expected after full project installation constitutes the benefit brought about by structural measures of the planned project. The structural measures, including the floodwater retarding structures and the channel improvement, were considered as interrelated measures, since all were required to provide the desired type and level of protection on a common damage area, and the project was evaluated as five reaches. The measures included in the plan are those that most nearly meet the desires of the local people at the lowest cost.

Farmers were asked what changes they would make in their flood plain farming operations if flood protection were provided. They indicated that they will plan a more intensive type of agriculture using irrigation from wells. They expected to do a better job of land leveling and water distribution. An increase in crop yields was also indicated. This information together with other data on land capability, markets, etc. was analyzed to determine the extent of land use intensification. The associated cost of accomplishing these practices plus the increased flood losses expected from higher damageable values were deducted from the increased income expected from the more intensive land use. The annual benefit in the form of the increased return was discounted to present worth and included as the benefit from more intensive land use in table 6.

The monetary value of the physical damage to the flood plain from scour and sediment was based on the value of production lost. This estimate took into account the lag in recovery of productivity and the cost of farm operations.

Secondary benefits, the net increase in the value of goods and services generated by the project, will be realized by workers, processors, and business establishments in the trade area. The evaluation of these benefits was limited to those which will occur locally as a result of processing and distribution of agricultural commodities made available by the protection afforded by the project.

Local secondary benefits were estimated to equal 10 percent of the primary benefits, with the exception of those resulting from reduction of indirect damages, plus 10 percent of the increased production expense resulting from the more intensive land use.

Areas that will be inundated by the sediment and detention pools of the floodwater retarding structures were excluded from the damage calculations. An estimate was made, however, of the value of the production that would be lost in those areas after installation of the project. Secondary costs resulting from the reduced value of agriculture production were appraised in the same manner as secondary benefits were estimated. In this appraisal it was considered that there would be no production in the sediment pools. The land covered by the detention pools was assumed to be converted to grassland under project conditions. The cost of land, easements, and rights-of-way for the 41 floodwater retarding structures was determined by individual appraisal in cooperation with representatives of the local organizations. The site costs for floodwater retarding structure were based on appraisals of the value of the easements with consideration given to the values that will remain after the land is devoted to project purposes. The average annual net loss in production, based on long-term prices, plus the secondary losses within the sites were calculated and these values compared with the amortized cost of the structure sites. The larger amount was used for economic evaluation of the project to assure a conservative estimate.

Details of the procedures used in the investigation are described in the Economics Guide for Watershed Protection and Flood Prevention (procedures for use with the frequency method).

Table A - Flood Plain Land Use and Value of Production
Tri-County Turkey Creek Watershed, Oklahoma
With and Without Project
(1961 Prices)

Land Use	Acres	Unit	Yield	Value of Production	Direct Production Cost	Operating Margin
				Without Project		
				(dollars)	(dollars)	(dollars)
Wheat	5,274	Bu.	19	182,374	65,398	116,976
Irrigated Wheat	721	Bu.	24	31,493	12,841	18,652
Cotton	186	Lb.	260	15,910	11,417	4,493
Irrigated Cotton	1,910	Lb.	750	471,292	333,677	137,615
Alfalfa	353	Ton	3	24,886	9,132	15,754
Irrigated Alfalfa	113	Ton	3.5	9,294	4,538	4,756
Grain Sorghum	712	Cwt.	21	24,222	13,528	10,694
Pasture	2,923	AUM	.4	2,958	1,023	1,935
Idle	136	-	-	-	-	-
Miscellaneous	190	-	-	-	-	-
Total	12,518 2/	xxx	xxx	762,429	451,554	310,875
				With Project		
Wheat	3,950	Bu.	19	136,591	48,980	87,611
Irrigated Wheat	1,954	Bu.	24	85,351	34,800	50,551
Cotton	86	Lb.	260	7,356	5,279	2,077
Irrigated Cotton	2,010	Lb.	900	595,161	351,147	244,014
Irrigated Alfalfa	681	Ton	4	64,014	27,349	36,665
Grain Sorghum	564	Cwt.	21	19,187	10,716	8,471
Irrigated Grain Sorghum	160	Cwt.	28	7,258	3,502	3,756
Pasture	2,923	AUM	.4	2,958	1,023	1,935
Miscellaneous	190	-	-	-	-	-
Total	12,518 2/	xxx	xxx	917,876	482,796	435,080

Gross Benefit	124,205
Less Deduction for Flood Damage to Higher Values	1,995
Less Deduction for Development Cost of Irrigation Systems 1/	41,086
Unadjusted Net Benefit	81,124
Adjusted for Long-Term Prices as Projected by ARS, September 1957	71,324
Net Benefit Adjusted for 5-Year Lag (Factor .914)	65,190

1/ Land leveling, wells drilled, and associated pump, motor, etc., amortized for 20 years at 6 percent.

2/ Includes fringe areas adjoining the flood plain.

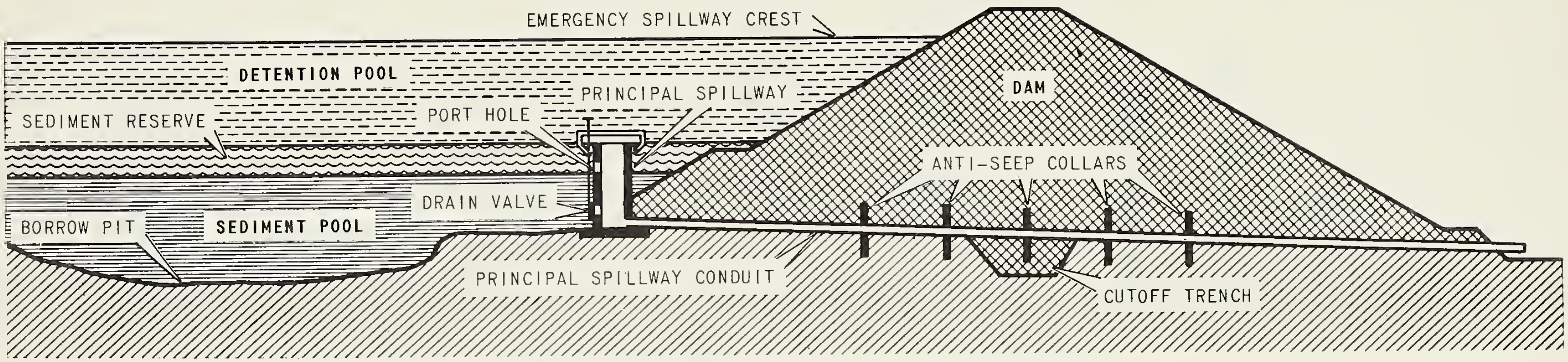


Figure I

SECTION OF A TYPICAL FLOODWATER RETARDING STRUCTURE

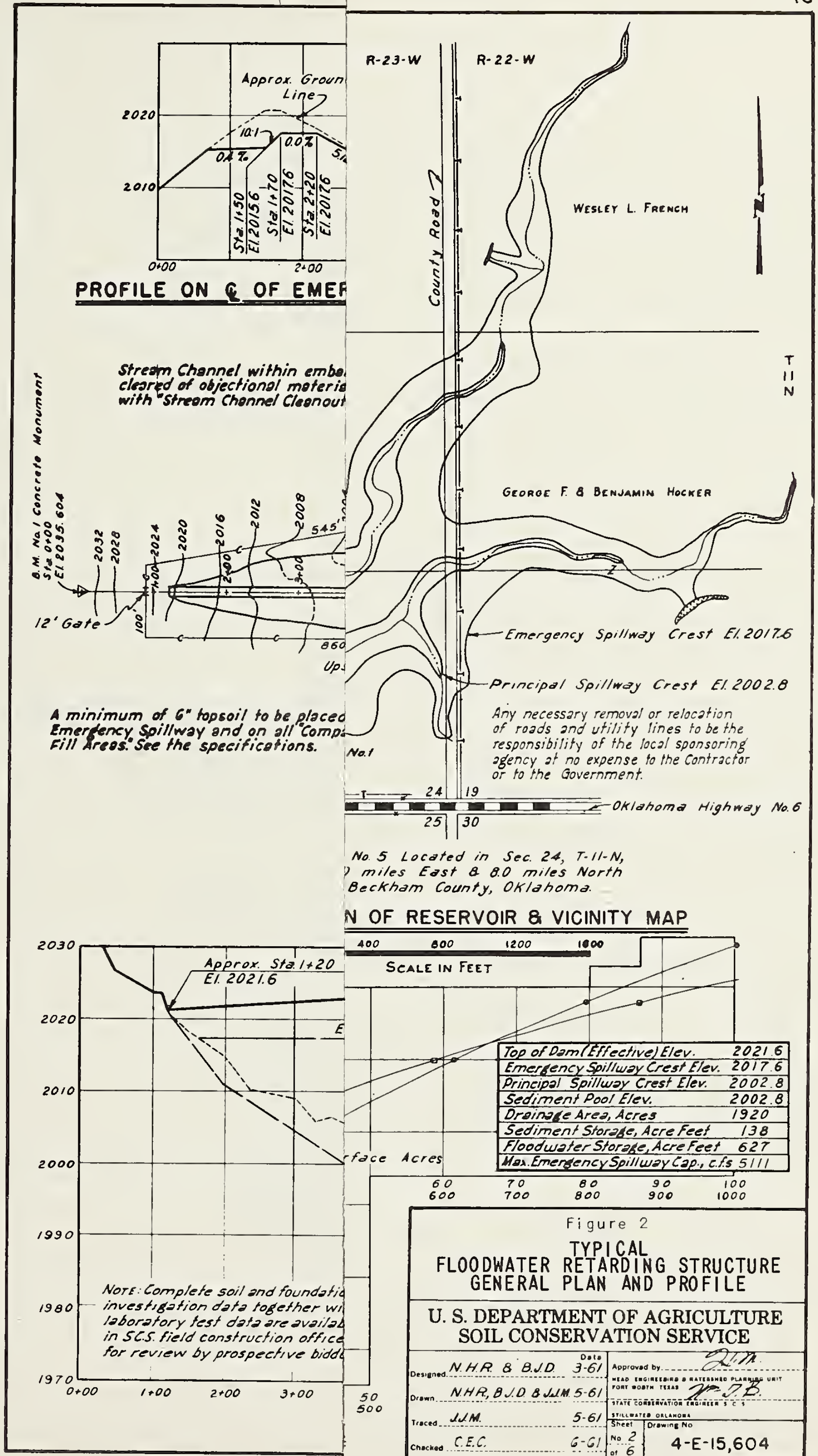


Figure 2
TYPICAL
FLOODWATER RETARDING STRUCTURE
GENERAL PLAN AND PROFILE

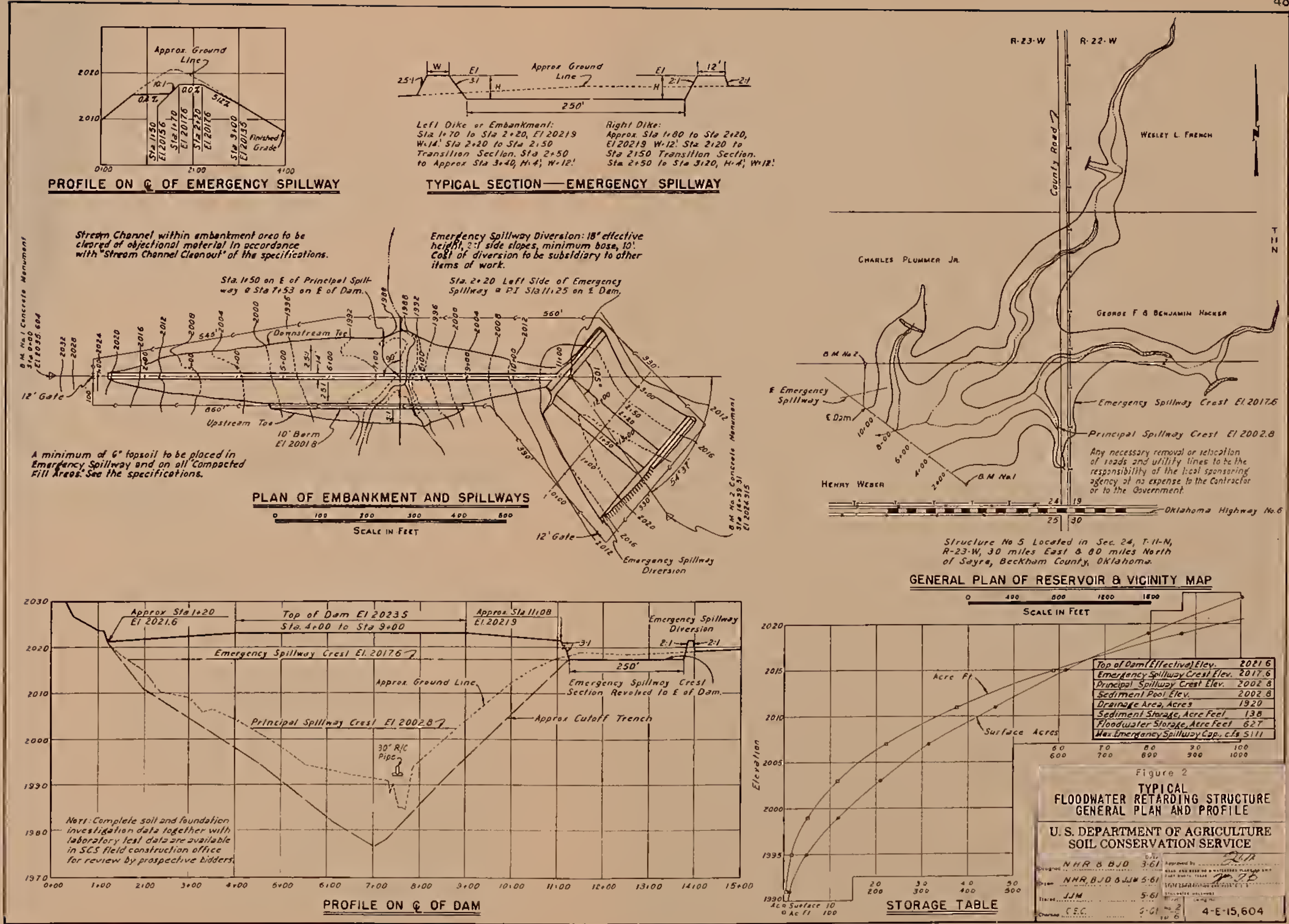
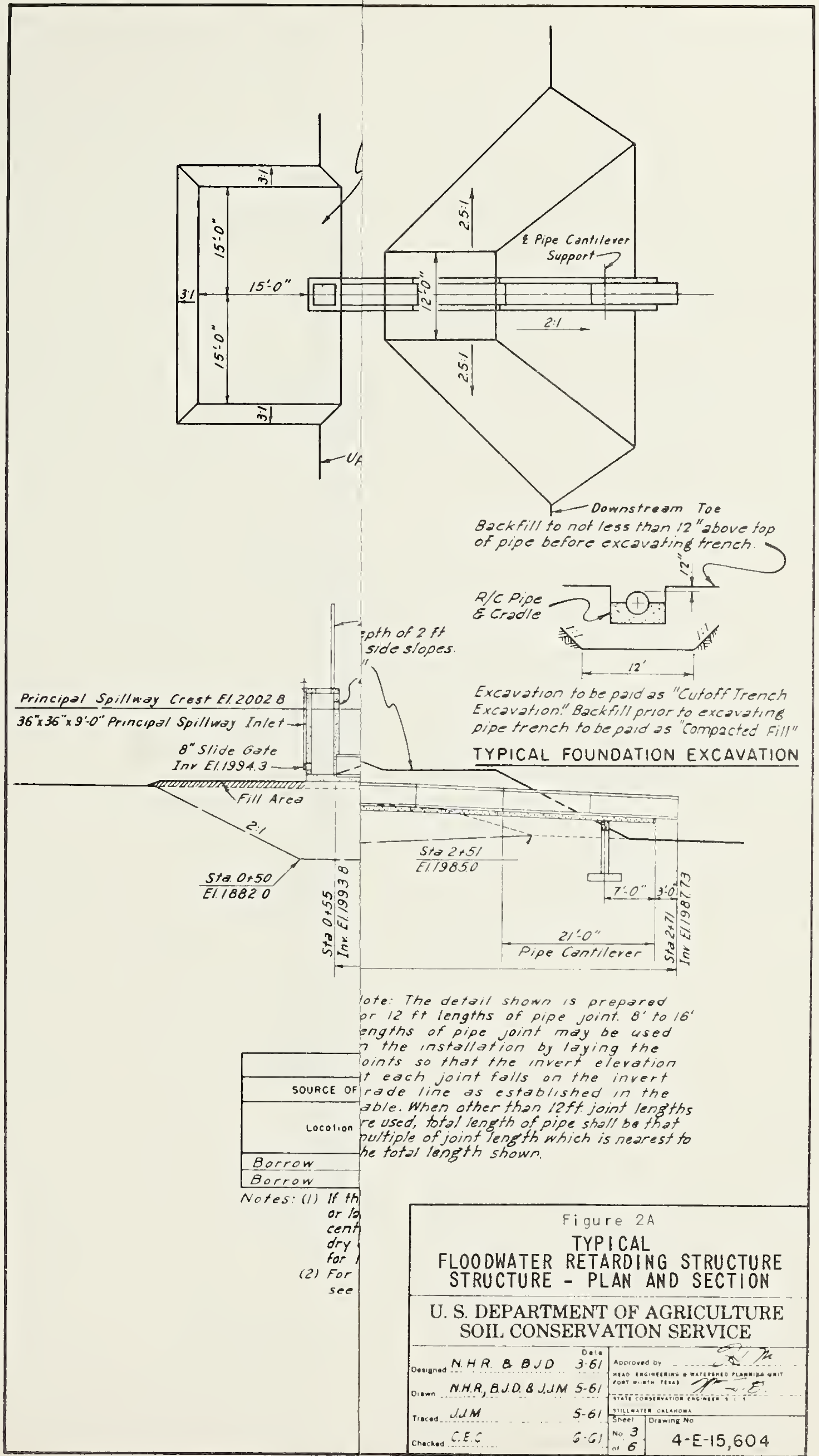
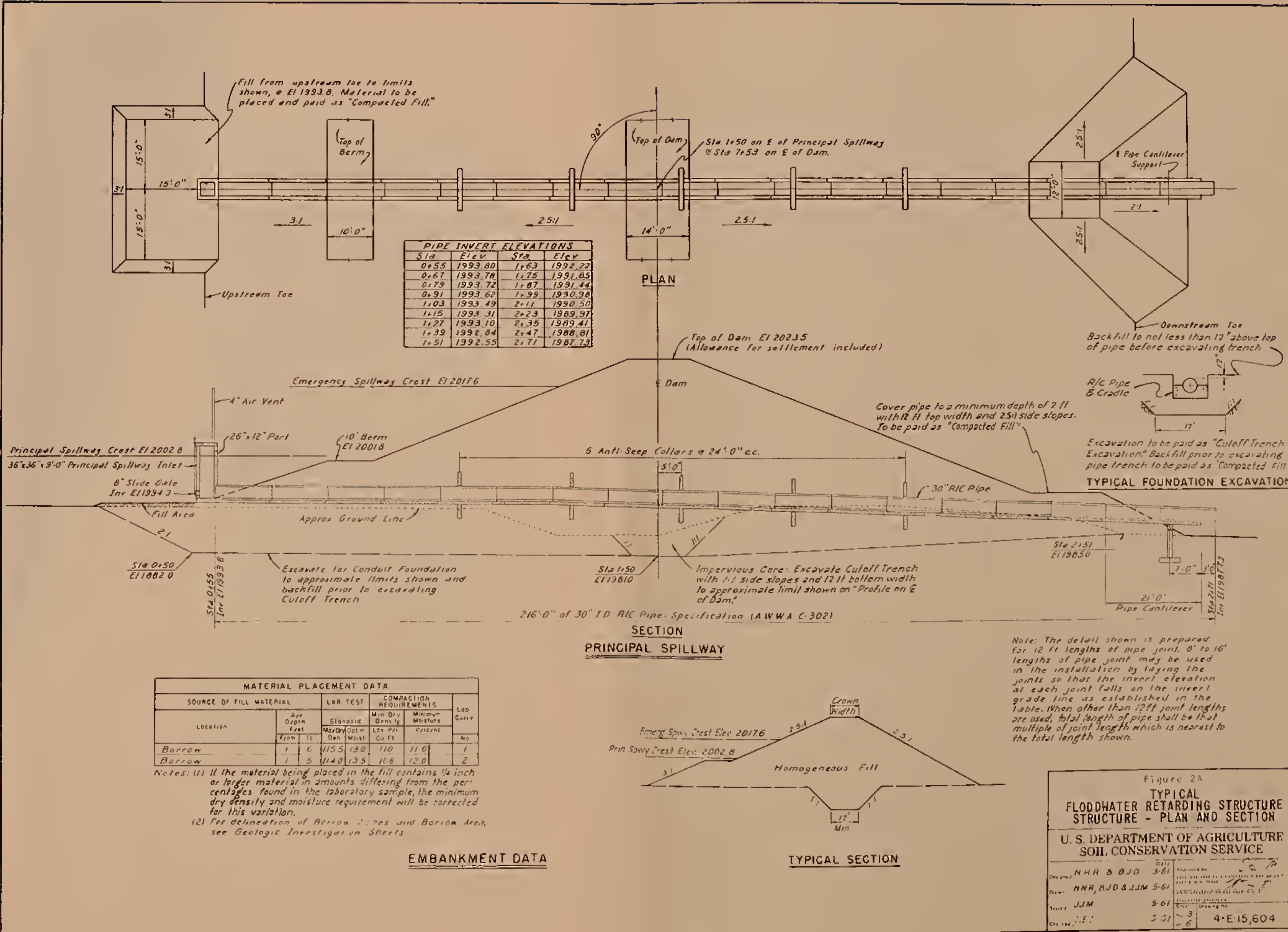


Figure 2
TYPICAL FLOODWATER RETARDING STRUCTURE GENERAL PLAN AND PROFILE



3:1
15'-0"
15'-0"
15'-0"
3:1
3:1
2.5:1
2.5:1
12'-0"
2:1
℄ Pipe Cantilever Support
Downstream Toe
Backfill to not less than 12" above top of pipe before excavating trench.
12"
R/C Pipe & Cradle
1:1
1:1
12'
Excavation to be paid as "Cutoff Trench Excavation." Backfill prior to excavating pipe trench to be paid as "Compacted Fill"
TYPICAL FOUNDATION EXCAVATION
Principal Spillway Crest El. 2002.8
36"x36"x9'-0" Principal Spillway Inlet
8" Slide Gate Inv El. 1994.3
Fill Area
2:1
Sta. 0+50 El. 1882.0
Sta 0+55 Inv. El. 1993.8
Sta 2+51 El. 1985.0
7'-0"
3'-0"
21'-0" Pipe Cantilever
Sta 2+71 Inv El. 1987.73
SOURCE OF
Location
Borrow
Borrow
Notes: (1) If th
(2) For
see
Note: The detail shown is prepared for 12 ft lengths of pipe joint. 8' to 16' lengths of pipe joint may be used in the installation by laying the joints so that the invert elevation at each joint falls on the invert grade line as established in the table. When other than 12 ft. joint lengths are used, total length of pipe shall be that multiple of joint length which is nearest to the total length shown.
Figure 2A
TYPICAL FLOODWATER RETARDING STRUCTURE STRUCTURE - PLAN AND SECTION
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
Designed N.H.R. & B.J.D. 3-61
Drawn N.H.R., B.J.D. & J.J.M. 5-61
Traced J.J.M. 5-61
Checked C.E.C. 6-61
Approved by
HEAD ENGINEERING & WATERSHED PLANNING UNIT FORT WORTH TEXAS
STATE CONSERVATION ENGINEER S.C.S.
STILLWATER OKLAHOMA
Sheet No. 3 of 6
Drawing No 4-E-15,604



PIPE INVERT ELEVATIONS

Sta	Elev.	Sta	Elev
0+55	1993.80	1+63	1992.22
0+67	1993.78	1+75	1991.85
0+79	1993.72	1+87	1991.44
0+91	1993.62	1+99	1990.98
1+03	1993.49	2+11	1990.50
1+15	1993.31	2+23	1989.97
1+27	1993.10	2+35	1989.41
1+39	1992.84	2+47	1988.81
1+51	1992.55	2+71	1987.73

MATERIAL PLACEMENT DATA

SOURCE OF FILL MATERIAL			LAB TEST		COMPACTION REQUIREMENTS		Lab Curve
Location	Avg Depth Feet		Standard		Min Dry Density	Minimum Moisture	
	From	To	Max Dry Den	Optm Moist	Lbs Per Cu Ft	Percent	No
Borrow	1	6	115.5	13.0	110	11.0	1
Borrow	1	5	114.0	13.5	108	12.0	2

Notes: (1) If the material being placed in the fill contains ¼ inch or larger material in amounts differing from the percentages found in the laboratory sample, the minimum dry density and moisture requirement will be corrected for this variation.

(2) For delineation of Borrow Zones and Borrow Areas, see Geologic Investigation Sheets

EMBANKMENT DATA

Note: The detail shown is prepared for 12 ft lengths of pipe joint. 8' to 16' lengths of pipe joint may be used in the installation by laying the joints so that the invert elevation at each joint falls on the invert grade line as established in the table. When other than 12 ft joint lengths are used, total length of pipe shall be that multiple of joint length which is nearest to the total length shown.

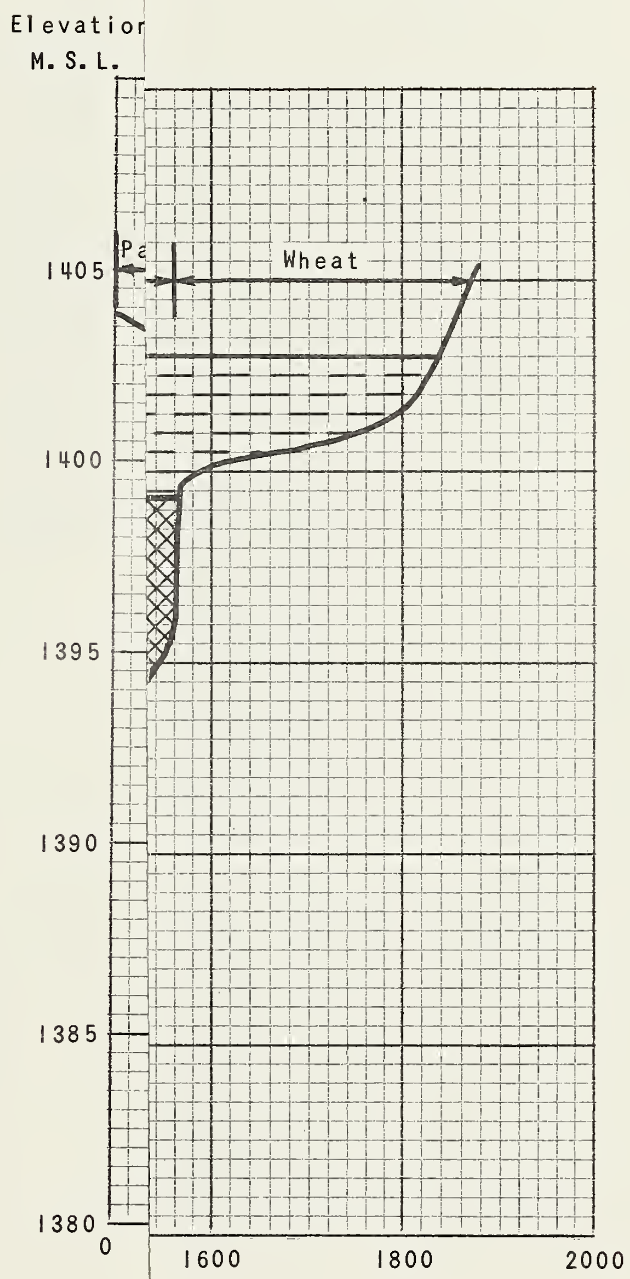
Figure 2A

TYPICAL FLOODWATER RETARDING STRUCTURE STRUCTURE - PLAN AND SECTION

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

		Date
Designed	NHR & BJD	3-61
Drawn	NHR, BJD & JJM	5-61
Traced	JJM	5-61
Checked		5-61

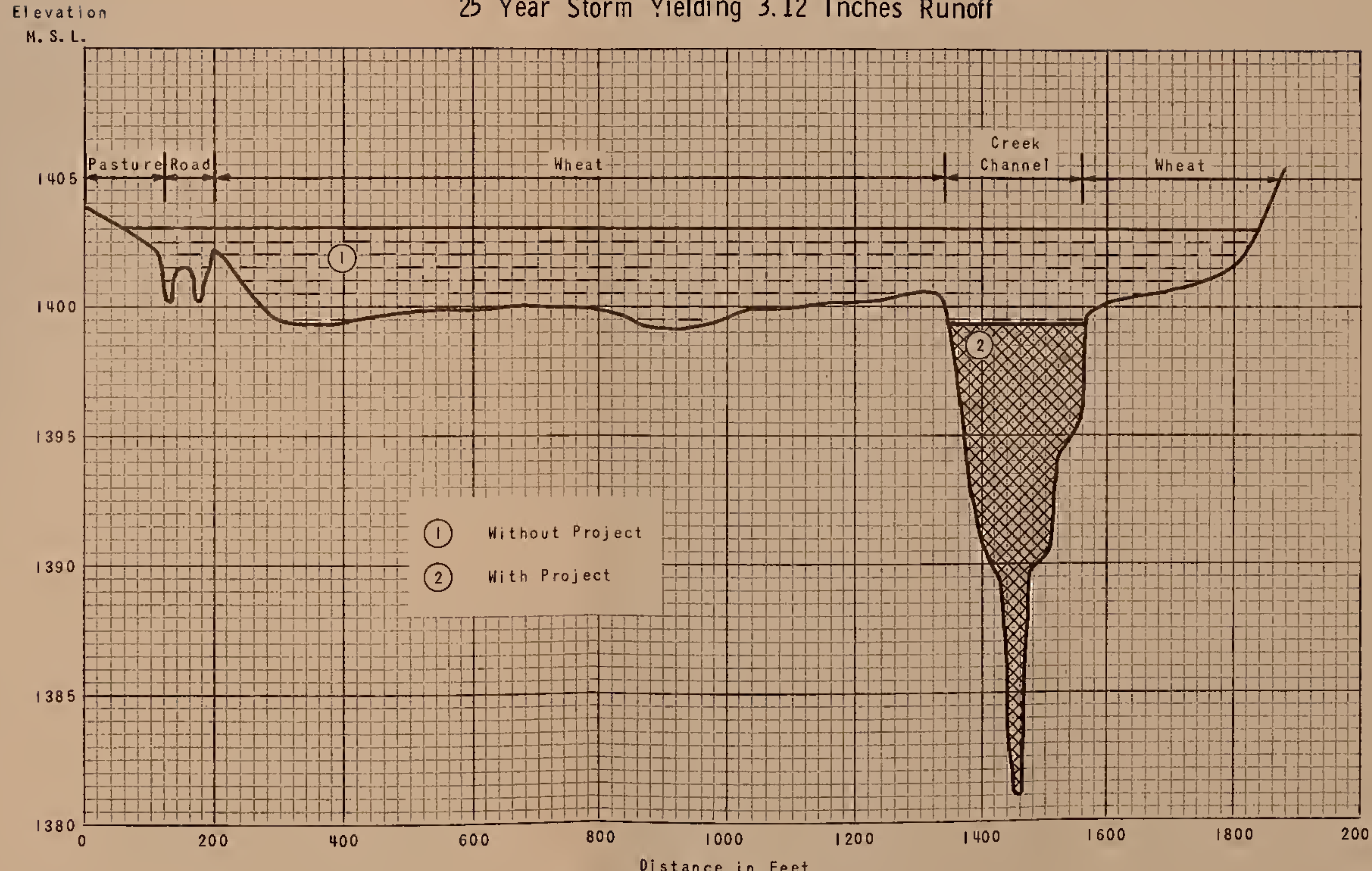
Drawing No. 4-E-15,604



Elevatior
M. S. L.
Pa
Wheat
1405
1400
1395
1390
1385
1380
0
1600
1800
2000

Figure 3

DEGREE OF FLOOD REDUCTION
TRI-COUNTY TURKEY CREEK
25 Year Storm Yielding 3.12 Inches Runoff



VALLEY SECTION NO. 19

U. S. DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE, Stillwater, Oklahoma 2-63 4-L-17639

4. 17638 2. 63

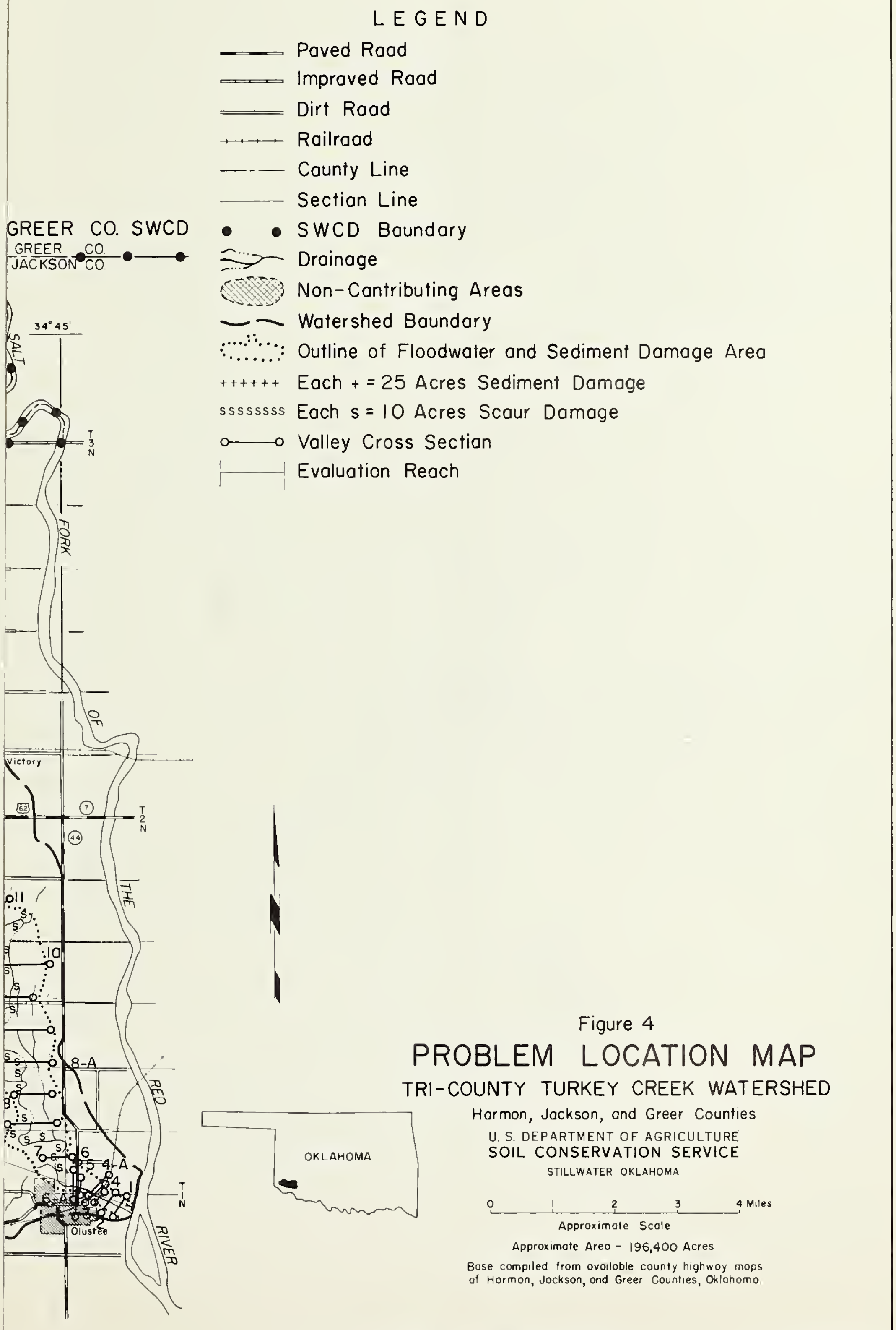


Figure 4

PROBLEM LOCATION MAP

TRI-COUNTY TURKEY CREEK WATERSHED

Harmon, Jackson, and Greer Counties

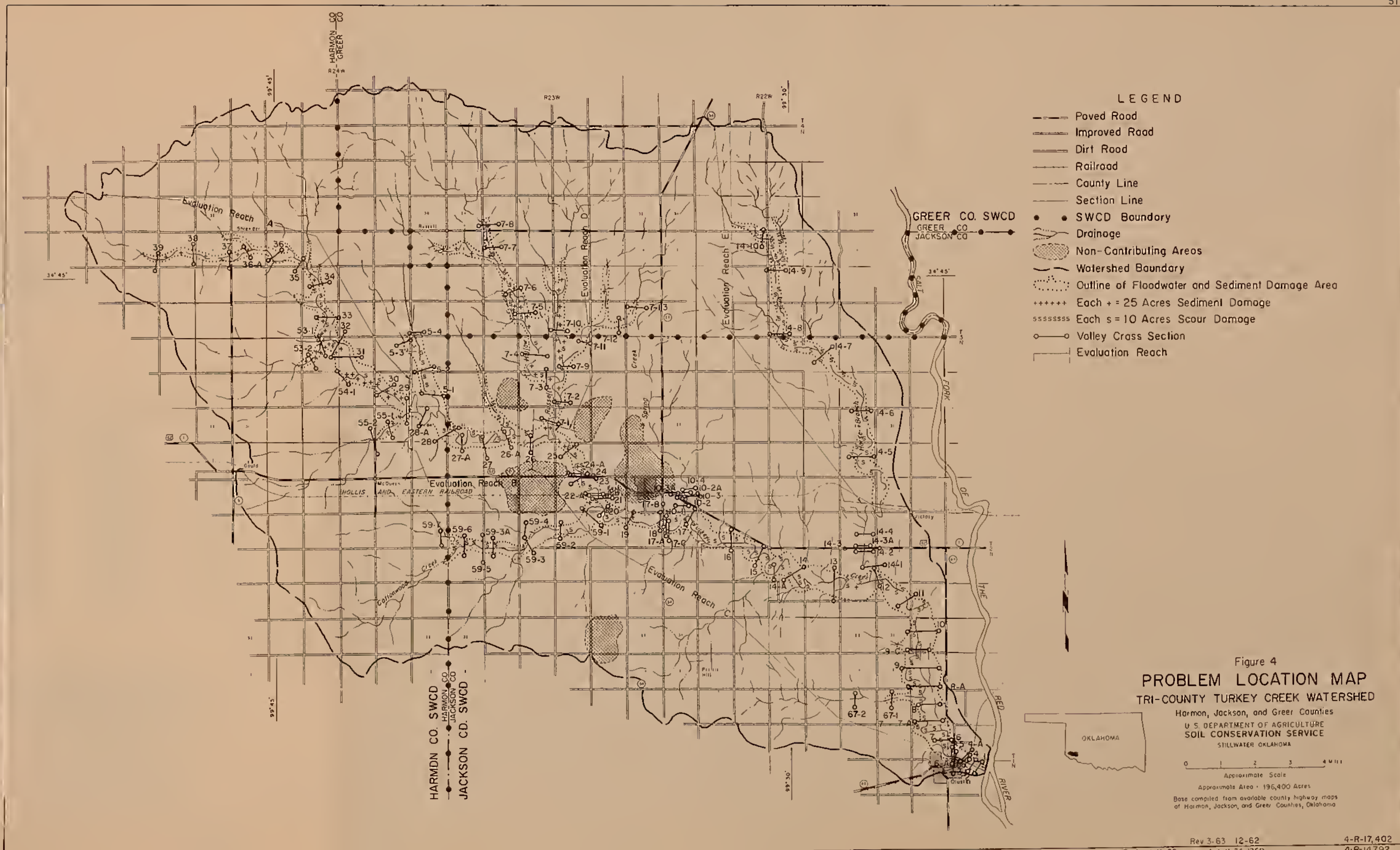
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
STILLWATER OKLAHOMA

Approximate Area - 196,400 Acres

Base compiled from available county highway maps of Harmon, Jackson, and Greer Counties, Oklahoma.

Rev. 3-63 12-62 4-R-17,402

Revised 11-62 August 24, 1960 4-R-14,792


LEGEND
Paved Road
Improved Road
Dirt Road
Railroad
County Line
Section Line
SWCD Boundary
Drainage
Non-Contributing Areas
Watershed Boundary
Outline of Floodwater and Sediment Damage Area
Each + = 25 Acres Sediment Damage
Each s = 10 Acres Scour Damage
Valley Cross Section
Evaluation Reach
GREER CO. SWCD
HARMON CO. SWCD
JACKSON CO. SWCD
Evaluation Reach A
Evaluation Reach B
Evaluation Reach C
Evaluation Reach D
Evaluation Reach E
HOLLIS AND EASTERN RAILROAD
SALT FORK OF THE RED RIVER
OKLAHOMA
Figure 4
PROBLEM LOCATION MAP
TRI-COUNTY TURKEY CREEK WATERSHED
Harmon, Jackson, and Greer Counties
U. S. DEPARTMENT OF AGRICULTURE
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STILLWATER OKLAHOMA
Approximate Scale
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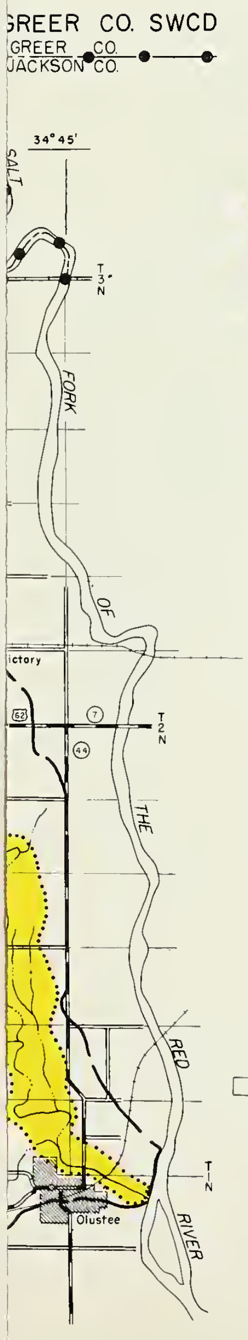

LEGEND

- Paved Road
- Improved Road
- Dirt Road
- Railroad
- County Line
- Section Line
- SWCD Boundary
- Drainage
- Non-Contributing Areas
- Watershed Boundary
- Floodwater Retarding Structure
- Drainage Area Controlled by Structure
- Benefited Area
- (5) Site Number
- Channel Improvement

SITE NUMBERS AND DRAINAGE AREAS IN ACRES

No.	Area	No.	Area	No.	Area
1A	3448	13	591	23	1130
1	10611	14A	1381	24	870
2A	1404	14B	1856	25	1030
2	3393	14C	728	26	6445
3	1433	14	3642	27	1056
4	646	15	1660	28A	933
5	5400	16A	960	28B	2234
6	820	16	3597	28C	1123
7	1914	17	1707	28D	698
8	1170	18	555	28	19600
9	1040	19	2862	29A	749
10	6242	20	1261	29B	906
11	858	21	1690	29	6134
12	512	22	8887		

Figure 5

PROJECT MAP

TRI-COUNTY TURKEY CREEK WATERSHED

Harmon, Jackson, and Greer Counties

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
STILLWATER, OKLAHOMA

0 1 2 3 4 Miles
Approximate Scale

Approximate Area - 196,400 Acres

Base compiled from available county highway maps of Harman, Jackson, and Greer Counties, Oklahoma.

Rev. 3-63 12-62 4-R-17,403
Revised 11-62 August 24, 1960 4-R-14,792

LEGEND

- Paved Road
- Improved Road
- Dirt Road
- Railroad
- County Line
- Section Line
- SWCO Boundary
- Drainage
- Non-Contributing Areas
- Watershed Boundary
- Floodwater Retarding Structure
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PROJECT MAP

TRI-COUNTY TURKEY CREEK WATERSHED

Harmon, Jackson, and Greer Counties

U S DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
STILLWATER OKLAHOMA

OKLAHOMA

0 1 2 3 4 Miles
Approximate Scale

Approximate Area - 196,400 Acres

Base compiled from available county highway maps of Harmon, Jackson, and Greer Counties, Oklahoma

Rev 3-63 12-62 4-R-17,403
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